

CoronaHack Chest Xray Classify Using Convolutional Neural Network



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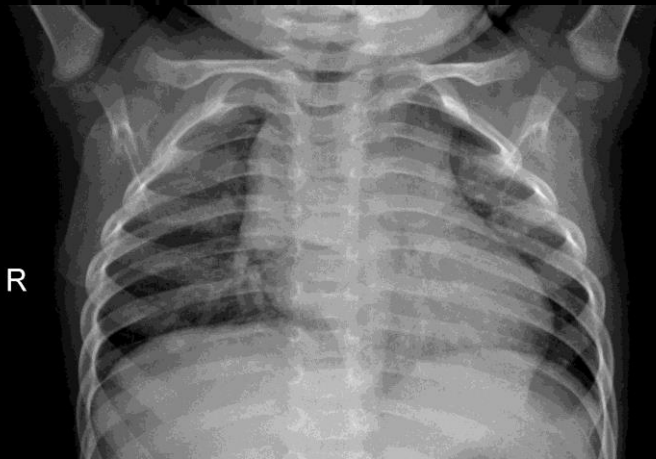
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Abstract

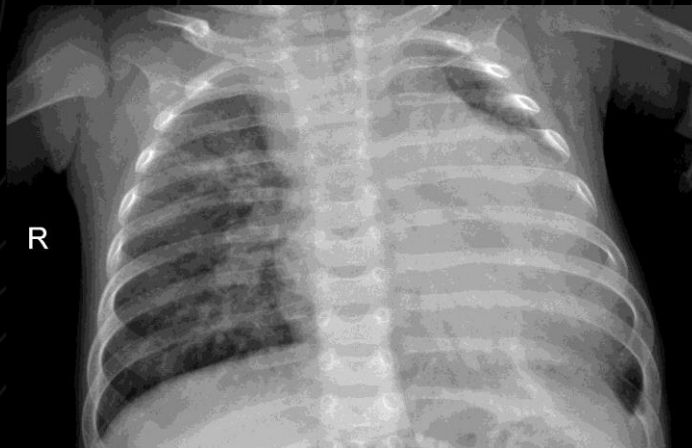
CoronaHack - Chest X-Ray Dataset is a chest X-ray dataset collected during the COVID-19 outbreak. The purpose of this dataset is to assist medical professionals in the diagnosis and treatment of patients with COVID-19. In this study, a convolutional neural network (CNN) was used to classify this dataset to assist in automated COVID-19 diagnosis. The results show that this CNN model has a high classification accuracy when performing two-class classification (Pneumonia, Normal), especially the detection accuracy of COVID-19 is as high as 94.55%. This study shows that using CNN can effectively classify chest X-rays and assist medical professionals in the diagnosis and treatment of COVID-19.

Introduction

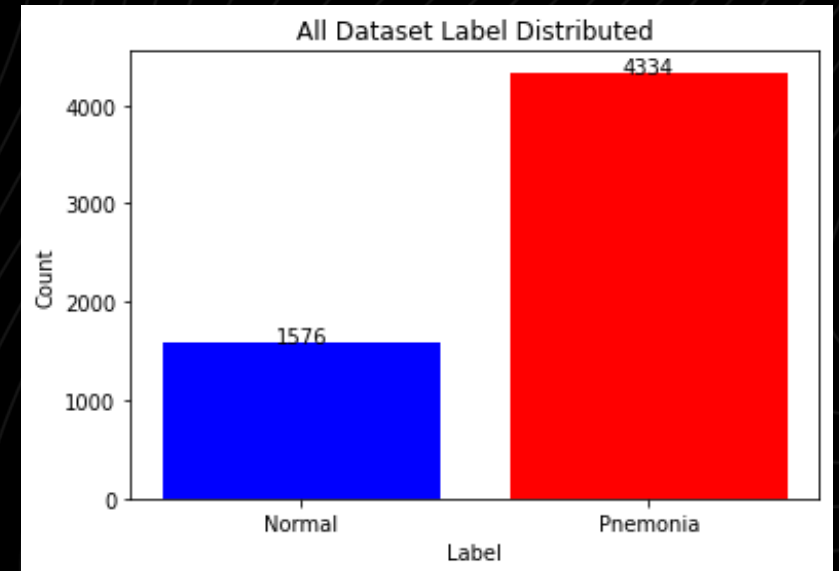
- Corona - COVID19 virus affects the respiratory system of healthy individual & Chest X - Ray is one of the important imaging methods to identify the corona virus.
- With the Chest X - Ray dataset, Develop a Machine Learning Model to classify the X Rays of Healthy vs Pneumonia (Corona) affected patients & this model powers the AI application to test the Corona Virus in Faster Phase.
- The training set has a total of 5286 images, 3944 images of the diseased and 1342 images of the non-diseased. The test set has a total of 624 images, 390 images with disease and 234 images without disease.



Normal



Pneumonia



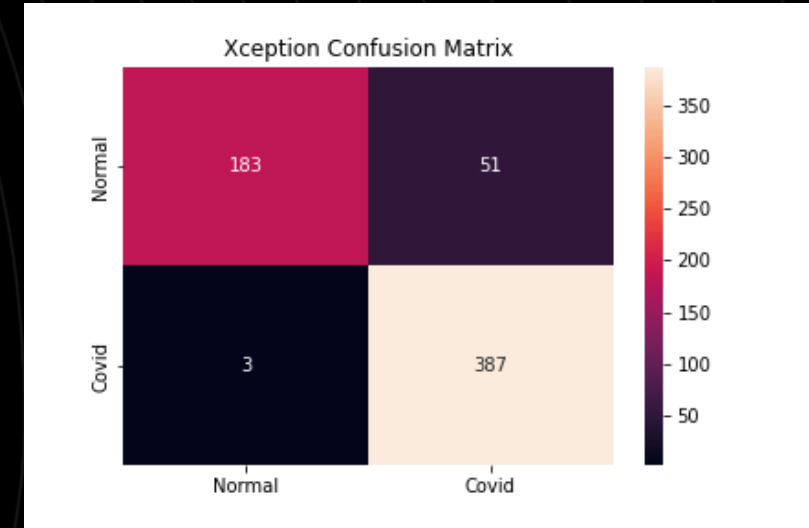
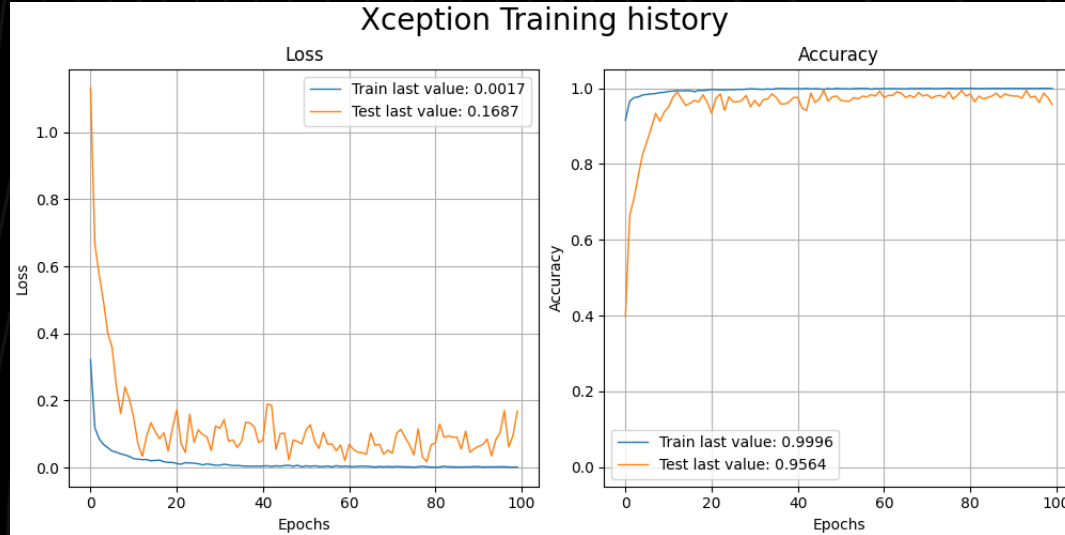
Dataset URI: <https://www.kaggle.com/datasets/praveengovi/coronahack-chest-xraydataset>

Method

- In this study, we employ various convolutional neural network models to classify the CoronaHack - Chest X-Ray Dataset. These models include **Xception, VGG16, VGG19, ResNet101V2, InceptionV3, InceptionResNetV2, EfficientNetV2S, and EfficientNetV2M** and self define.
- These models are all trained on ImageNet and have good image recognition capabilities. We use these pre-trained models to classify pneumonia and normal chest radiographs. By fine-tuning the weights of these pre-trained models, we can apply these models to our classification tasks and can effectively improve the classification accuracy of the models.
- Because the database is limited, we use image enhancement technology (**random scaling and random brightness adjustment and random movement of height and width**), the optimizer uses **Adamax**, the learning rate is **0.0001**, and the training is **100** times.

Experiment and Results(Xception)

The accuracy of this Xception model is as high as 91.34%



Results on test set:

Accuracy:0.9134615384615384

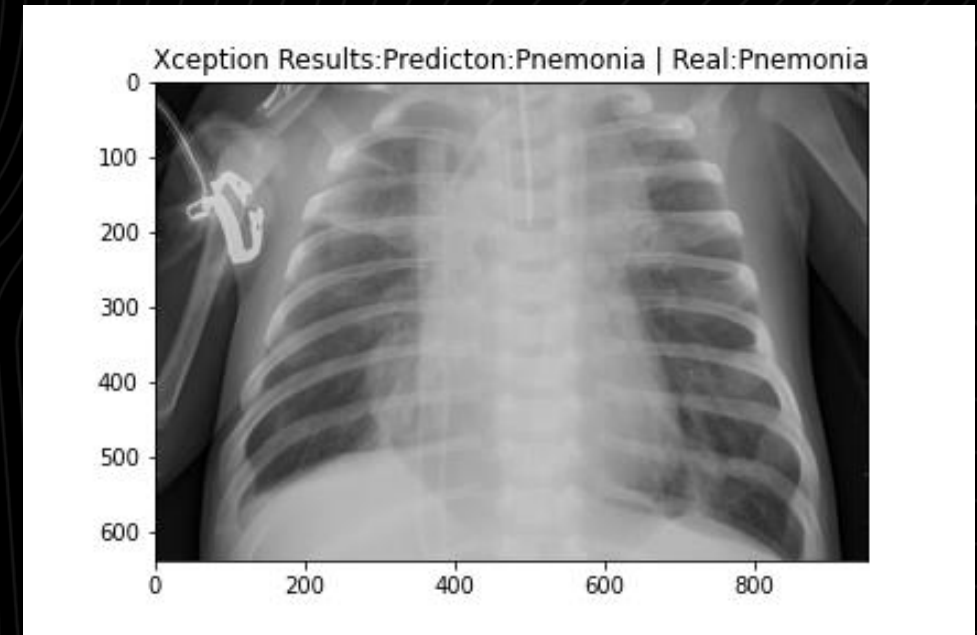
F1-Score:0.9110248447204969

Recall:0.9134615384615384

Precision:0.921177640300486

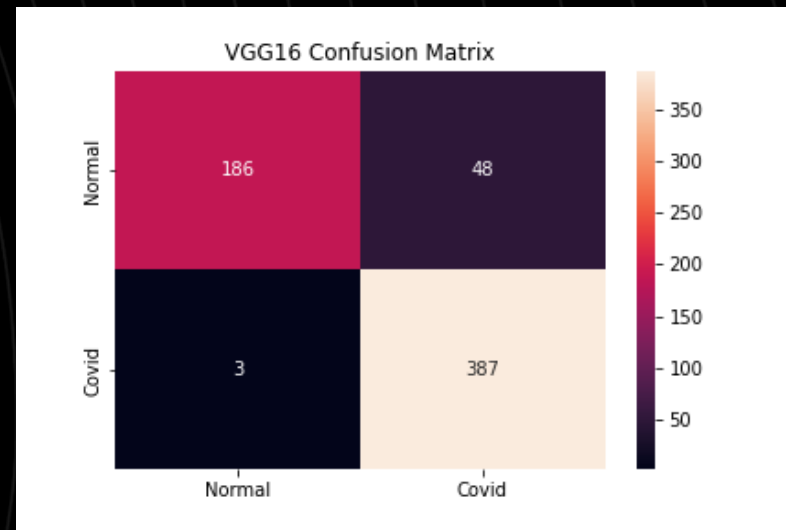
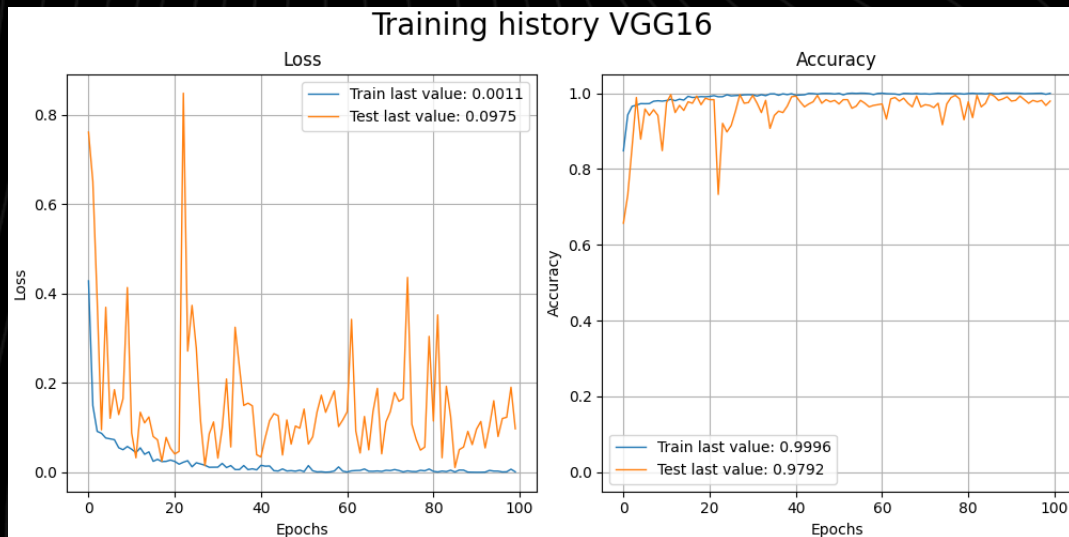
ROC AUC score: 0.8871794871794871

	precision	recall	f1-score	support
Normal	0.98	0.78	0.87	234
Covid	0.88	0.99	0.93	390
accuracy			0.91	624
macro avg	0.93	0.89	0.90	624
weighted avg	0.92	0.91	0.91	624



Experiment and Results(VGG16)

The accuracy of this VGG16 model is as high as 91.82%



Results on test set:

Accuracy:0.9182692307692307

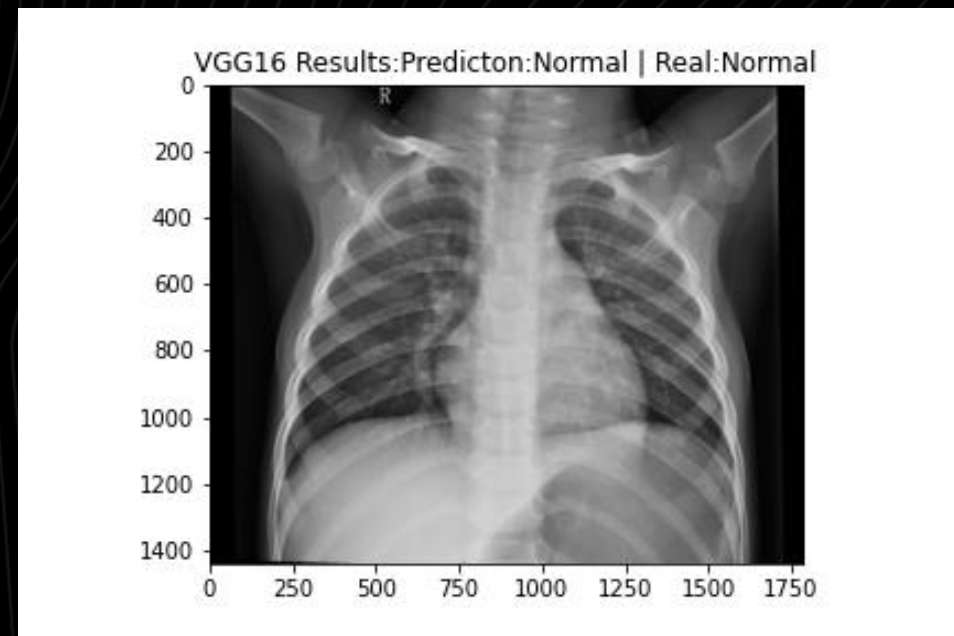
F1-Score:0.9161508704061896

Recall:0.9182692307692307

Precision:0.9250821018062396

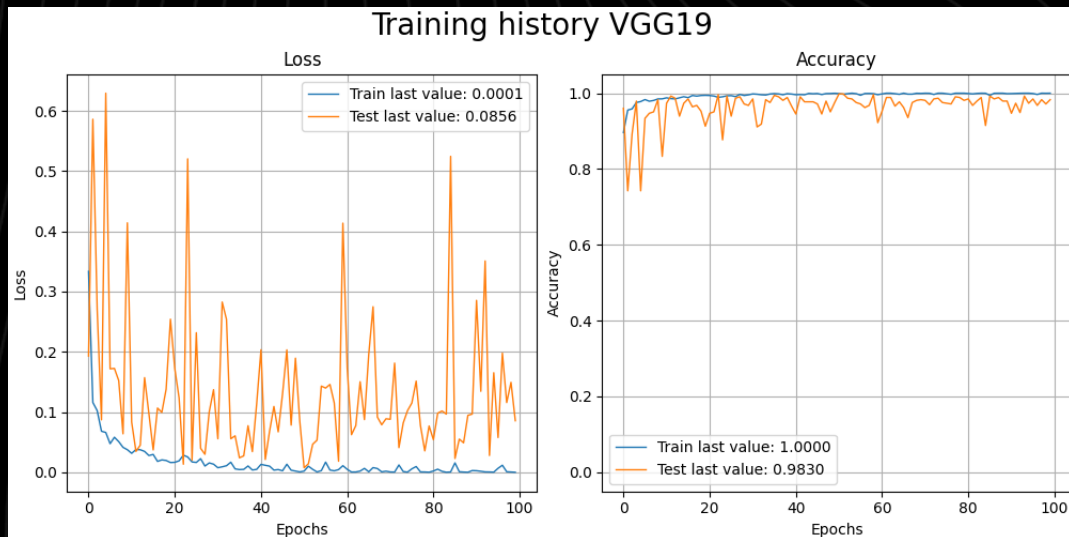
ROC AUC score: 0.8935897435897437

	precision	recall	f1-score	support
Normal	0.98	0.79	0.88	234
Covid	0.89	0.99	0.94	390
accuracy			0.92	624
macro avg	0.94	0.89	0.91	624
weighted avg	0.93	0.92	0.92	624



Experiment and Results(VGG19)

The accuracy of this VGG19 model is as high as 94.55%



Results on test set:

Accuracy:0.9455128205128205

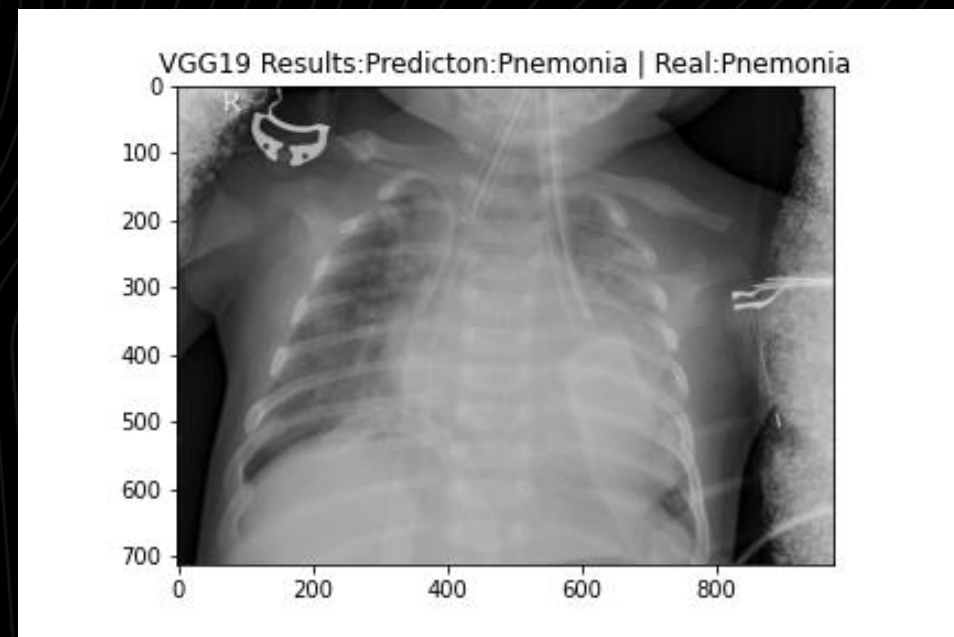
F1-Score:0.9447232223222323

Recall:0.9455128205128205

Precision:0.9481871603103079

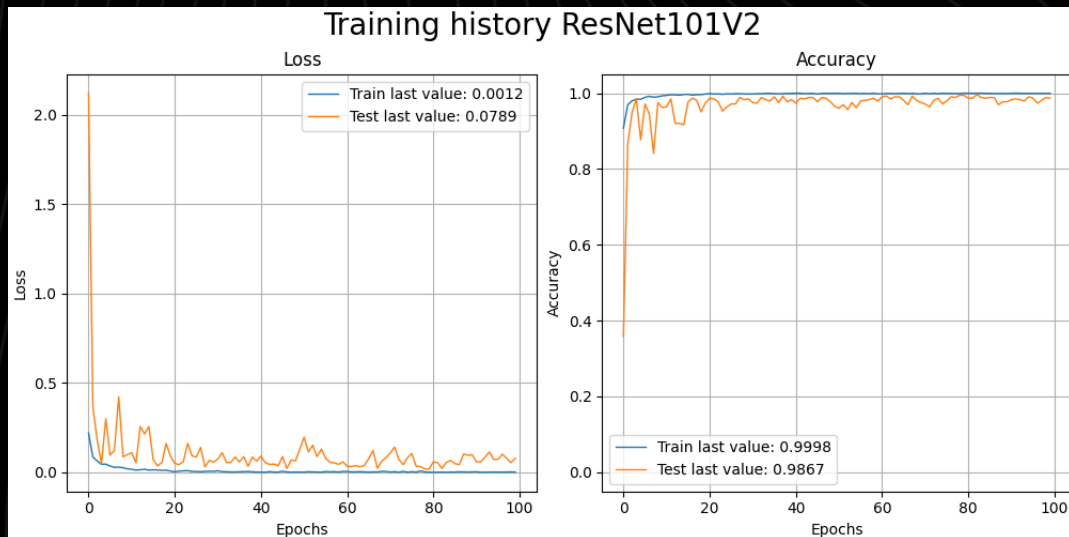
ROC AUC score: 0.9299145299145299

	precision	recall	f1-score	support
Normal	0.99	0.87	0.92	234
Covid	0.93	0.99	0.96	390
accuracy			0.95	624
macro avg	0.96	0.93	0.94	624
weighted avg	0.95	0.95	0.94	624



Experiment and Results(ResNet101V2)

The accuracy of this ResNet101V2 model is as high as 90.54%



Results on test set:

Accuracy:0.905448717948718

F1-Score:0.9028576803660312

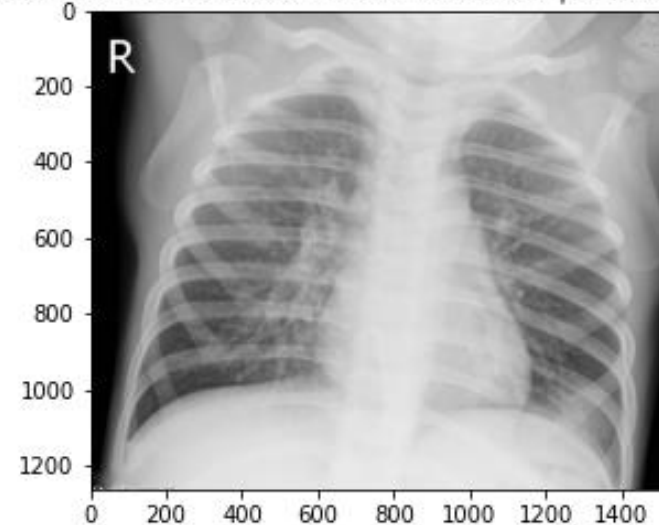
Recall:0.905448717948718

Precision:0.912166999106695

ROC AUC score: 0.879059829059829

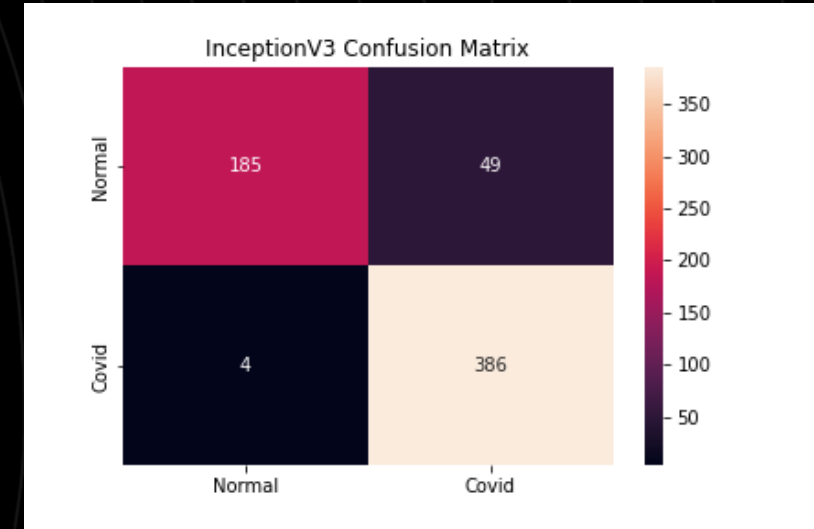
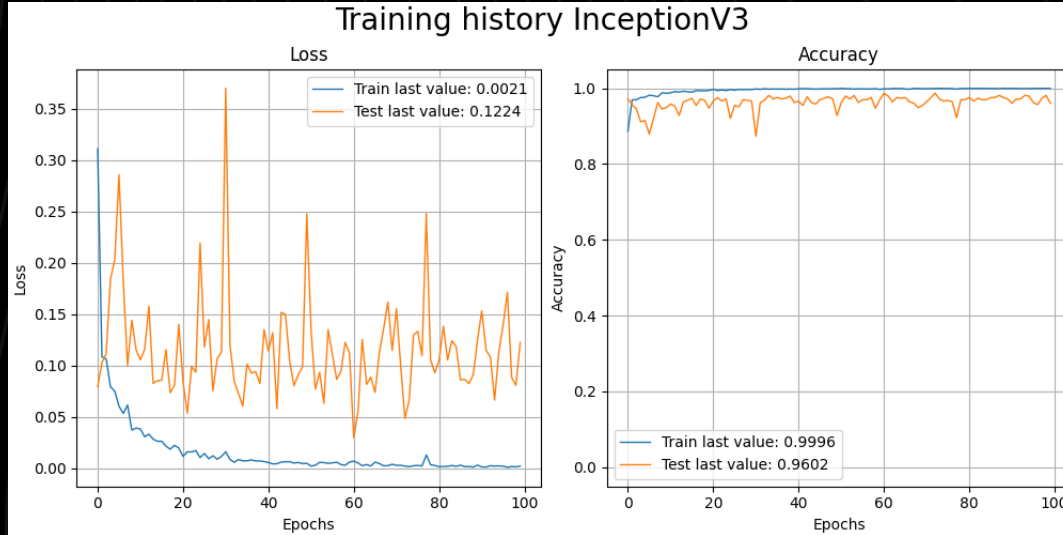
	precision	recall	f1-score	support
Normal	0.97	0.77	0.86	234
Covid	0.88	0.98	0.93	390
accuracy			0.91	624
macro avg	0.92	0.88	0.89	624
weighted avg	0.91	0.91	0.90	624

ResNet101V2 Results:Predicton:Pnemonia | Real:Pnemonia



Experiment and Results(InceptionV3)

The accuracy of this InceptionV3 model is as high as 91.50%



Results on test set:

Accuracy:0.9150641025641025

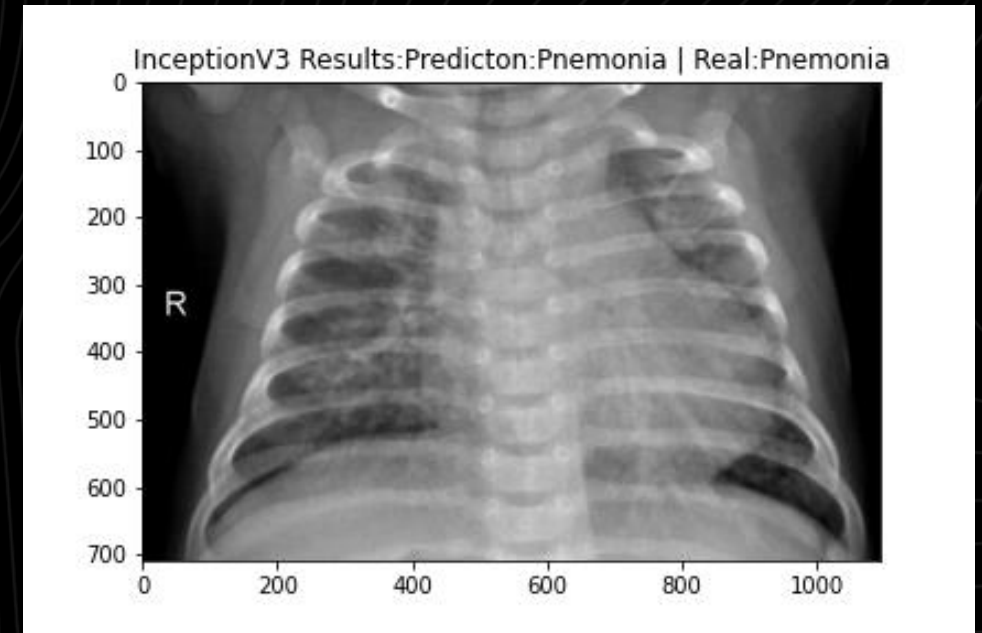
F1-Score:0.9128626692456481

Recall:0.9150641025641025

Precision:0.9216611932129174

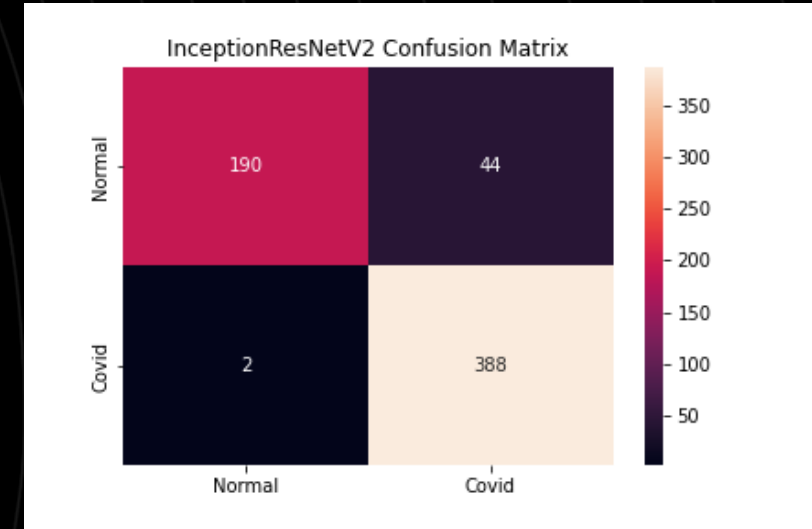
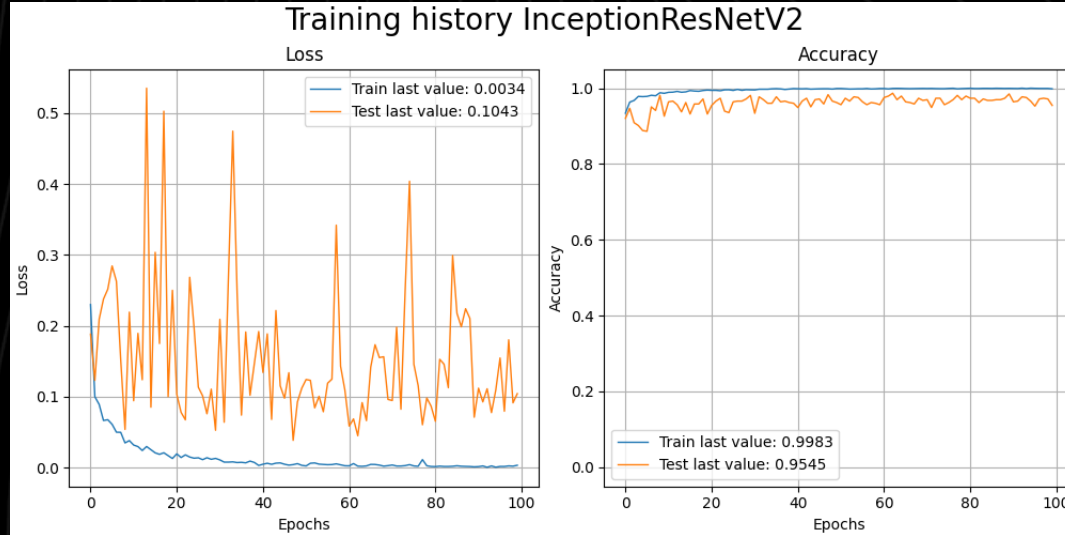
ROC AUC score: 0.8901709401709401

	precision	recall	f1-score	support
Normal	0.98	0.79	0.87	234
Covid	0.89	0.99	0.94	390
accuracy			0.92	624
macro avg	0.93	0.89	0.91	624
weighted avg	0.92	0.92	0.91	624



Experiment and Results(InceptionResNetV2)

The accuracy of this InceptionResNetV2 model is as high as 92.46%



Results on test set:

Accuracy:0.9246794871794872

F1-Score:0.9228368236723609

Recall:0.9246794871794872

Precision:0.9311194878057628

ROC AUC score: 0.9012820512820513

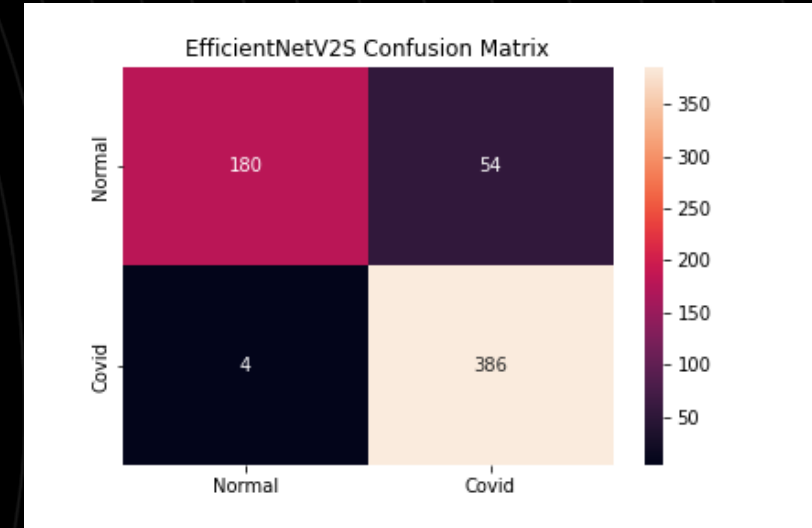
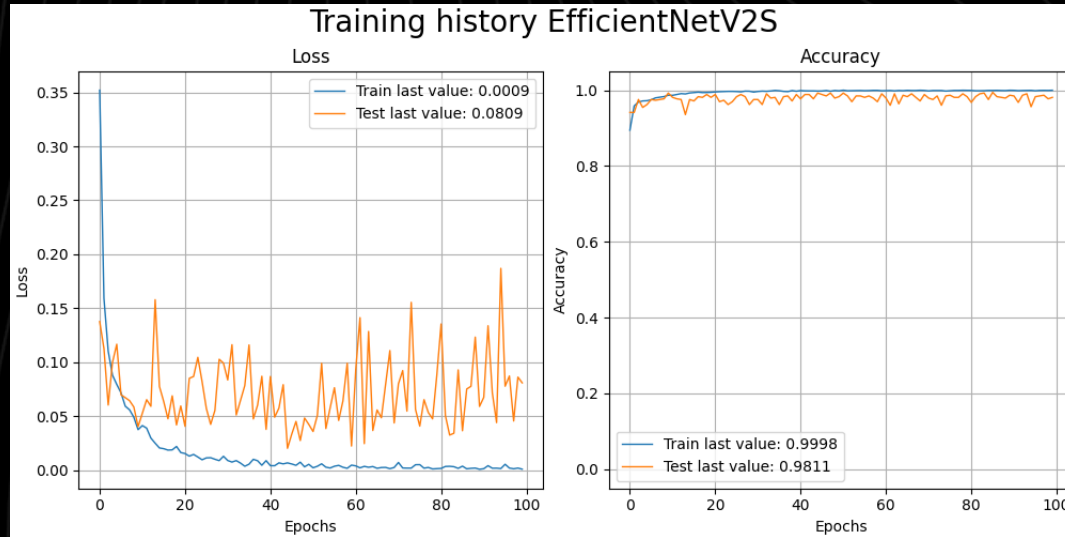
	precision	recall	f1-score	support
Normal	0.99	0.81	0.89	234
Covid	0.90	0.99	0.94	390
accuracy			0.92	624
macro avg	0.94	0.90	0.92	624
weighted avg	0.93	0.92	0.92	624

InceptionResNetV2 Results:Predicton:Pneumonia | Real:Pneumonia



Experiment and Results(EfficientNetV2S)

The accuracy of this EfficientNetV2S model is as high as 90.70%



Results on test set:

Accuracy:0.907051282051282

F1-Score:0.9042918083818529

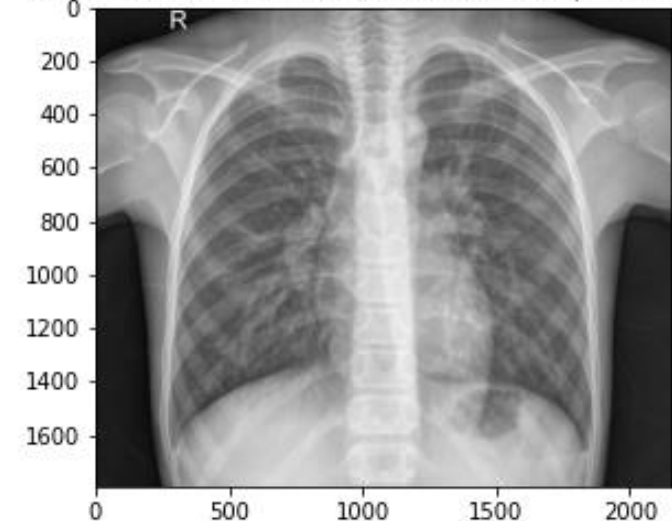
Recall:0.907051282051282

Precision:0.915143280632411

ROC AUC score: 0.8794871794871795

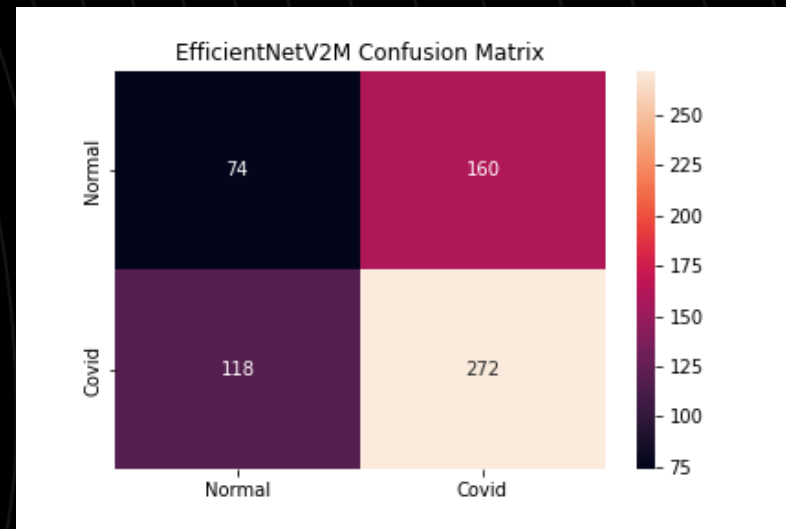
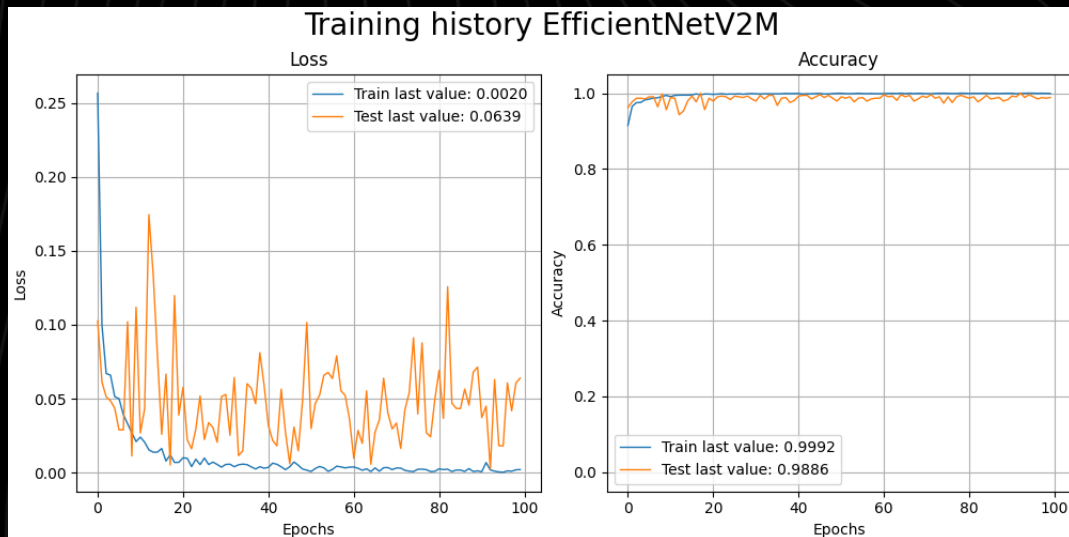
	precision	recall	f1-score	support
Normal	0.98	0.77	0.86	234
Covid	0.88	0.99	0.93	390
accuracy			0.91	624
macro avg	0.93	0.88	0.90	624
weighted avg	0.92	0.91	0.90	624

EfficientNetV2S Results:Predicton:Normal | Real:Normal



Experiment and Results(EfficientNetV2M)

The accuracy of this EfficientNetV2M model is as high as 92.30%



Results on test set:

Accuracy:0.9230769230769231

F1-Score:0.9212501285082758

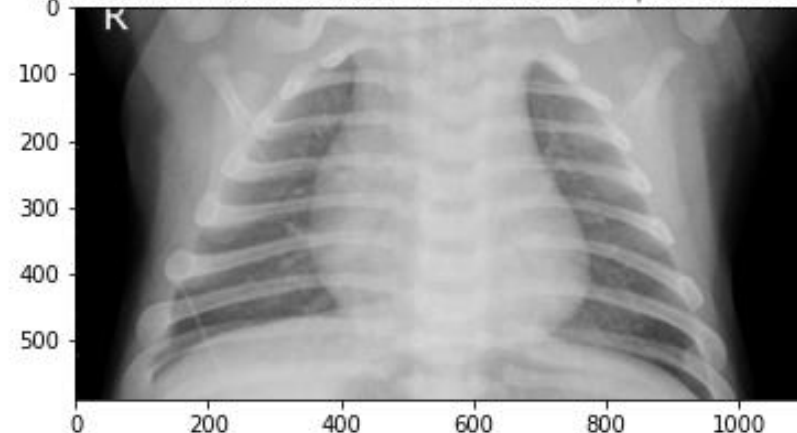
Recall:0.9230769230769231

Precision:0.9290364583333334

ROC AUC score: 0.9

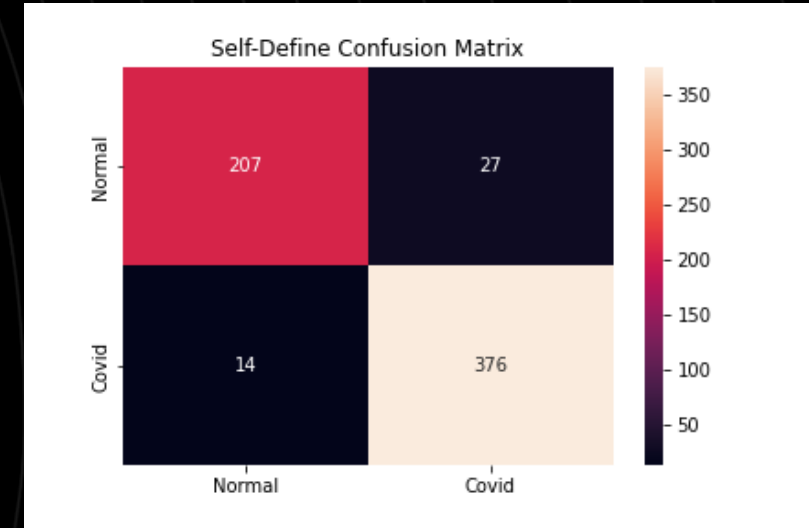
	precision	recall	f1-score	support
Normal	0.98	0.81	0.89	234
Covid	0.90	0.99	0.94	390
accuracy			0.92	624
macro avg	0.94	0.90	0.91	624
weighted avg	0.93	0.92	0.92	624

EfficientNetV2M Results:Predicton:Pneumonia | Real:Pneumonia



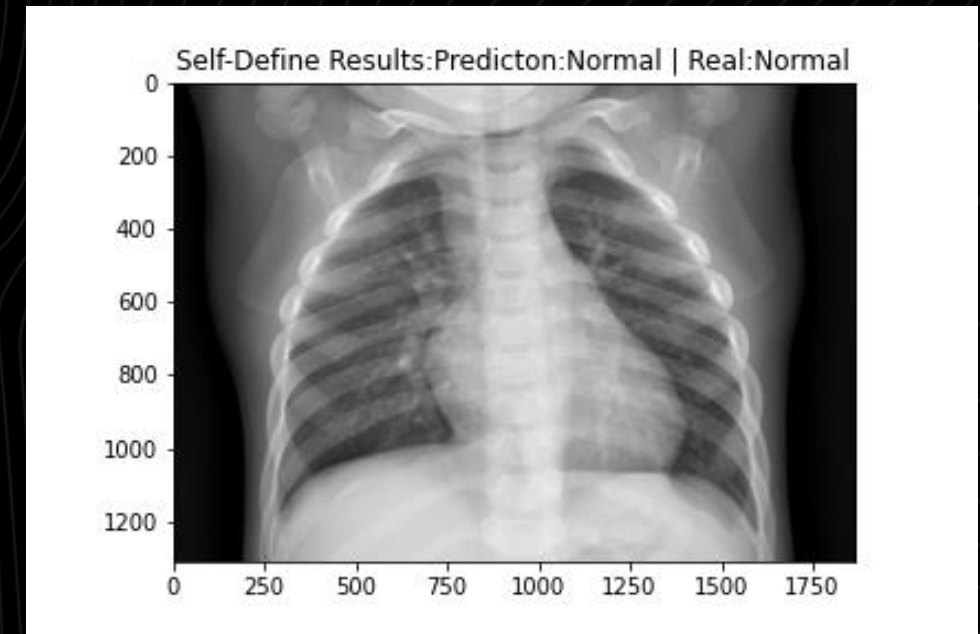
Experiment and Results(Self-Define)

The accuracy of this Self-Define model is as high as 93.42%



```
Results on test set:
-----
Accuracy:0.9342948717948718
-----
F1-Score:0.9338947937308593
-----
Recall:0.9342948717948718
-----
Precision:0.934370894759889
-----
ROC AUC score: 0.9243589743589744
-----
```

	precision	recall	f1-score	support
Normal	0.94	0.88	0.91	234
Covid	0.93	0.96	0.95	390
accuracy			0.93	624
macro avg	0.93	0.92	0.93	624
weighted avg	0.93	0.93	0.93	624



Conclusion

- In this study, we used multiple convolutional neural network (CNN) models to classify the CoronaHack - Chest X-Ray Dataset collected during the COVID-19 pandemic, with the aim of assisting in the automation of COVID-19 diagnosis. Through experimental comparisons of various models, we found that the **VGG19 model had the highest classification accuracy**, followed by the **Self-Define, InceptionResNetV2, and EfficientNetV2M models**. The COVID-19 detection accuracy of these models reached an extremely high level.
- These results indicate that CNN models have high accuracy in classifying chest X-rays, which can effectively assist medical professionals in diagnosing and treating COVID-19. In addition, this study provides an open and reliable chest X-ray dataset, which can promote the development and progress of related research.
- In the future, we can further study how to optimize the performance of these models and develop more effective automated COVID-19 diagnosis systems to address the challenges of the COVID-19 pandemic.

Thank You For Listening



AI Xray Recognition Platform URI: <http://wade0125studio.ddns.net:8080>

Source Code URI: https://github.com/Wade0125Studio/CoronaHack-Chest-X-Ray_classify