CSE4009 CAPSTONE Project

COVID-19 detection and analysis on CXRs using various CNN models

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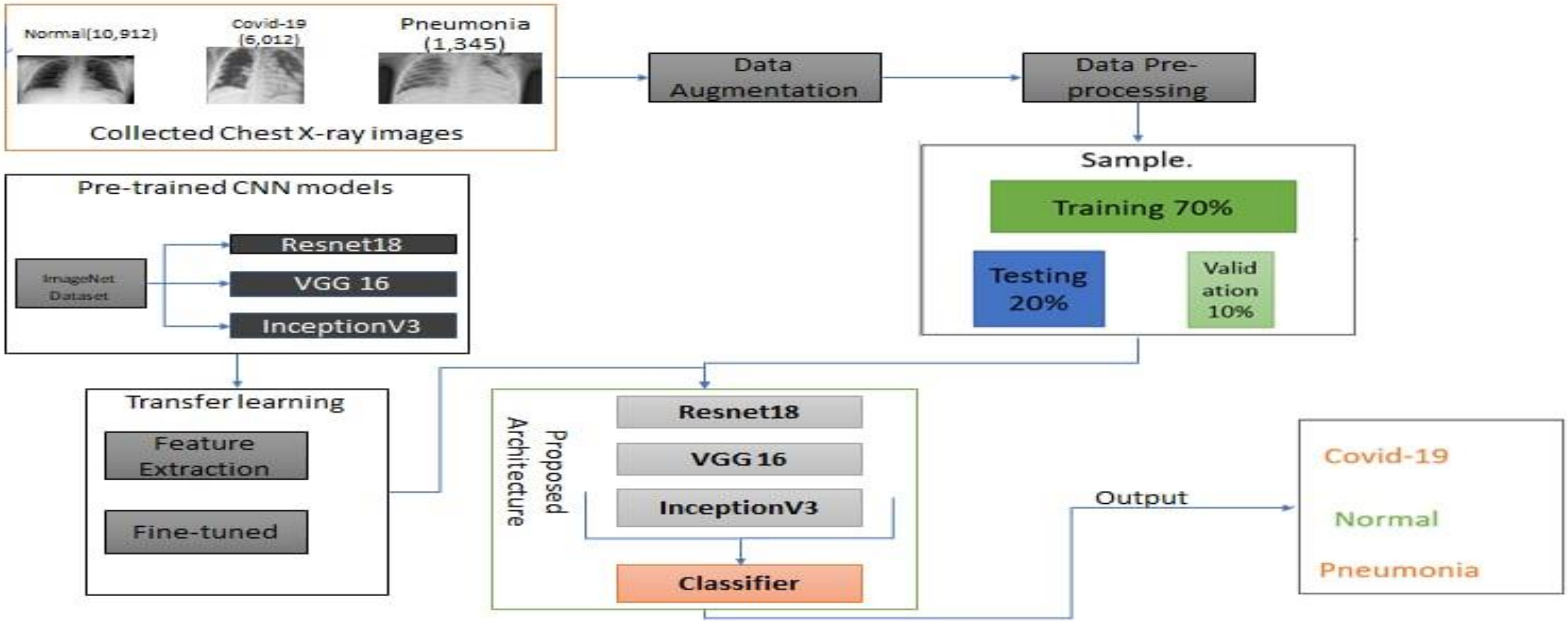
Proposed methodology



Project Structure

- Task 01 *Importing the Dataset from Kaggle*
- Task 02 *Importing Libraries*
- Task 03 *Preparing Training and Test Sets*
- Task 04 *Creating Custom Dataset*
- Task 05 *Image Transformations*
- Task 06 *Prepare DataLoader*
- Task 07 *Data Visualization*
- Task 08 *Creating the Model*
- Task 09 *Training the Model*
- Task 10 *Show the Predictions*
- Task 11 *Saving the Model*
- Task 12 *Inference on a Single Image*

Evaluation metrics

1. Confusion metrics (CM)
2. receiver operating characteristics (ROC) and AUC

- TP: It's when the model correctly predicts the positive class. Here, positive class refers to a COVID 19 patient.
- TN: It's when the model correctly predicts the negative class. Here, negative class refers to a patient NOT suffering from COVID 19.
- FP: It's when the model incorrectly predicts the positive class. Predicted that a patient suffering from COVID-19 but it's wrong.
- FN: It's when the model incorrectly predicts the negative class. Predicted that a patient NOT suffering from COVID-19 but it's wrong.

$$\text{Accuracy} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{TN} + \text{FN} + \text{FP}},$$

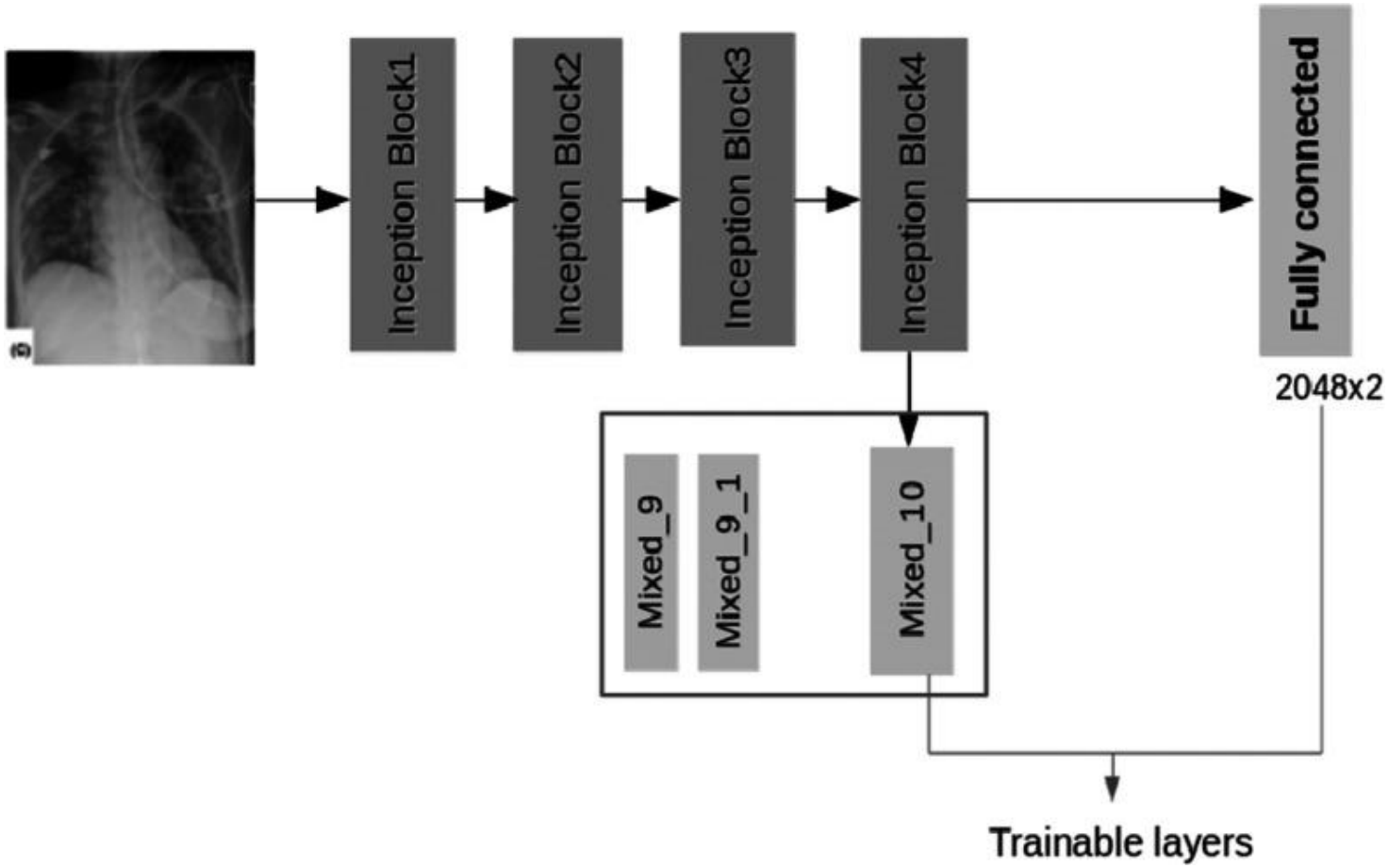
$$F\text{-1 score} = \frac{2 \times \text{precision} \times \text{recall}}{\text{Precision} + \text{recall}}.$$

$$\text{Precision} = \frac{\text{TP}}{\text{TP} + \text{FP}}.$$

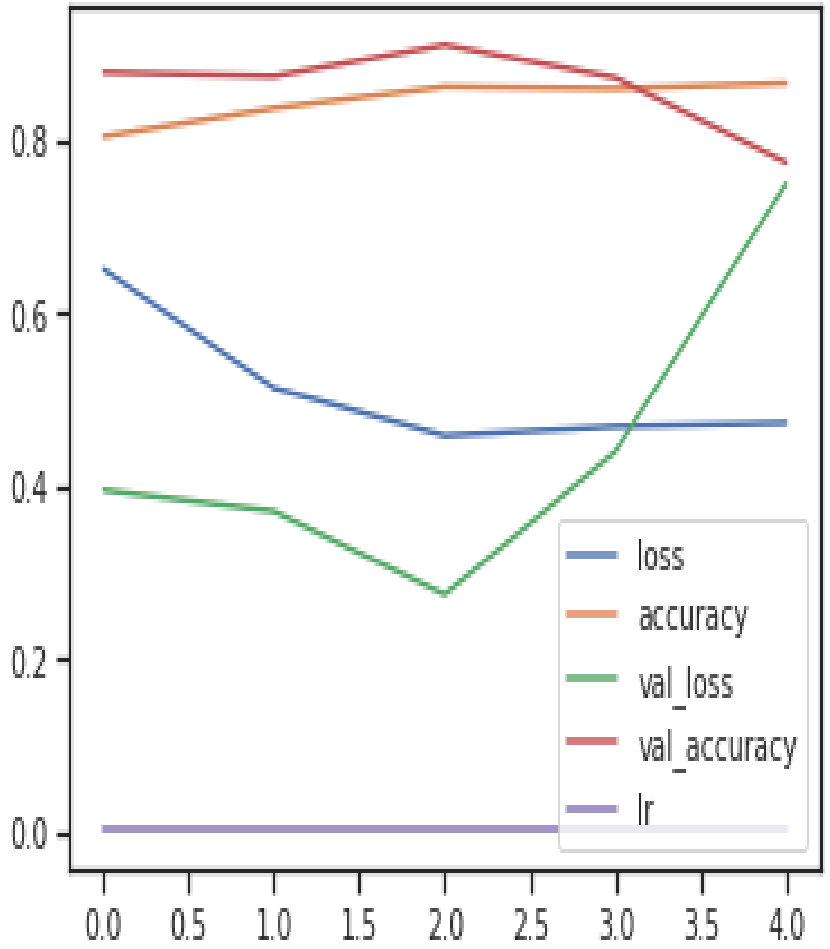
$$\text{Recall} = \frac{\text{TP}}{\text{TP} + \text{FN}}.$$

$$\text{MCC} = \frac{(\text{TP} \times \text{TN}) - (\text{FP} \times \text{FN})}{\sqrt{(\text{TP} + \text{FP})(\text{TP} + \text{FN})(\text{TN} + \text{FP})(\text{TN} + \text{FN})}}.$$

Proposed InceptionV3 architecture



Training performance plots

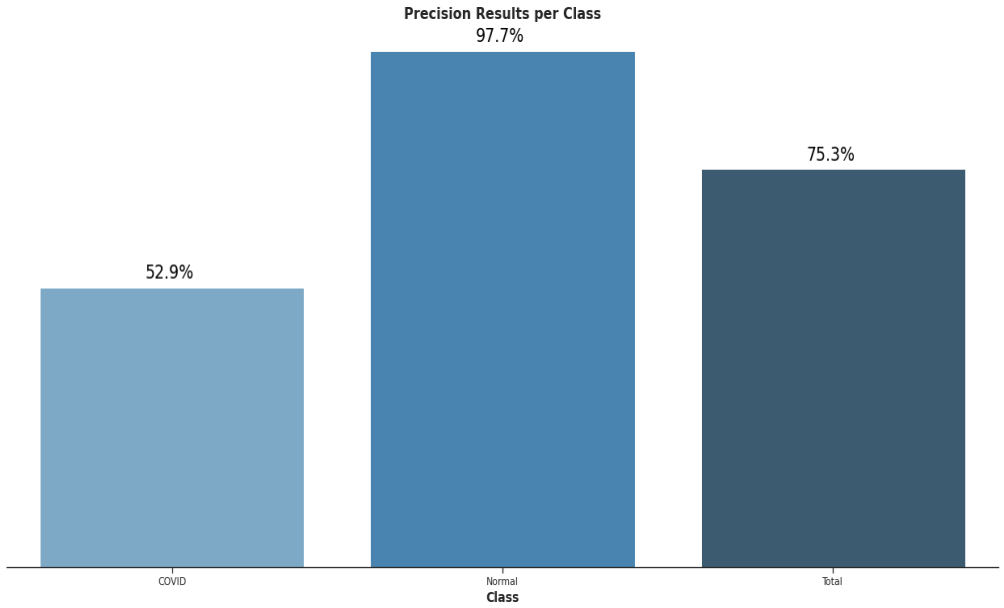


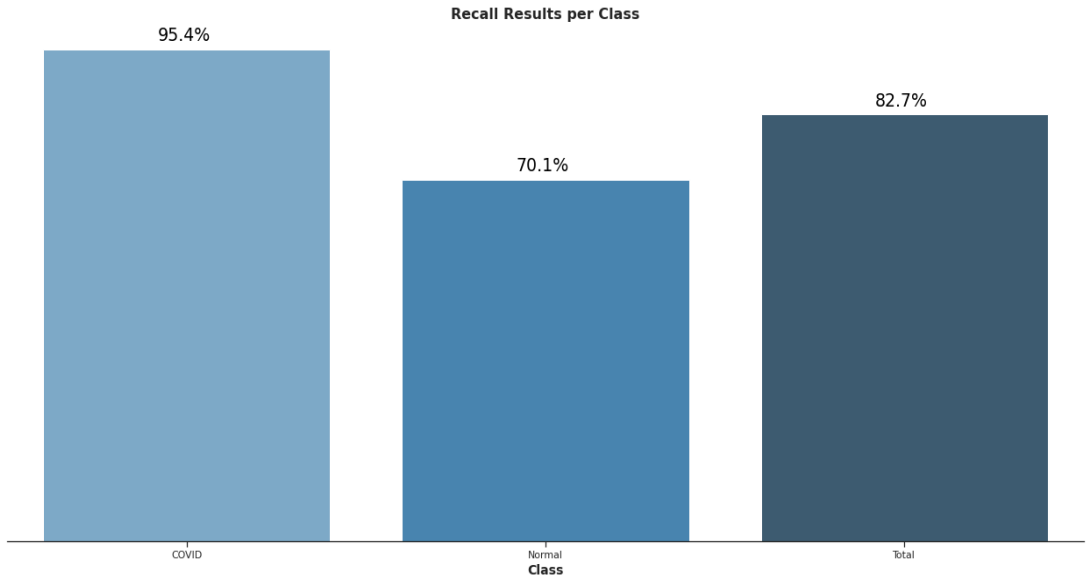
Confusion matrix

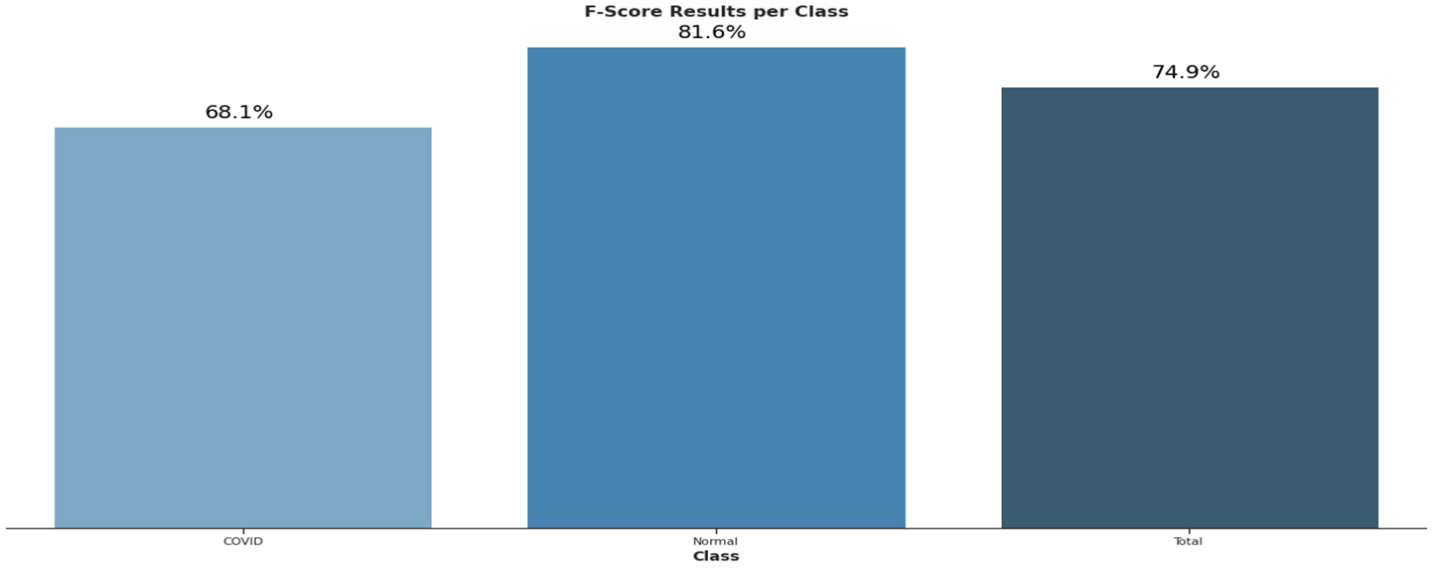
Classification report

	precision	recall	f1-score	support
NORMAL	0.53	0.95	0.68	1248
COVID	0.98	0.70	0.82	3537
accuracy			0.77	4785
macro avg	0.75	0.83	0.75	4785
weighted avg	0.86	0.77	0.78	4785

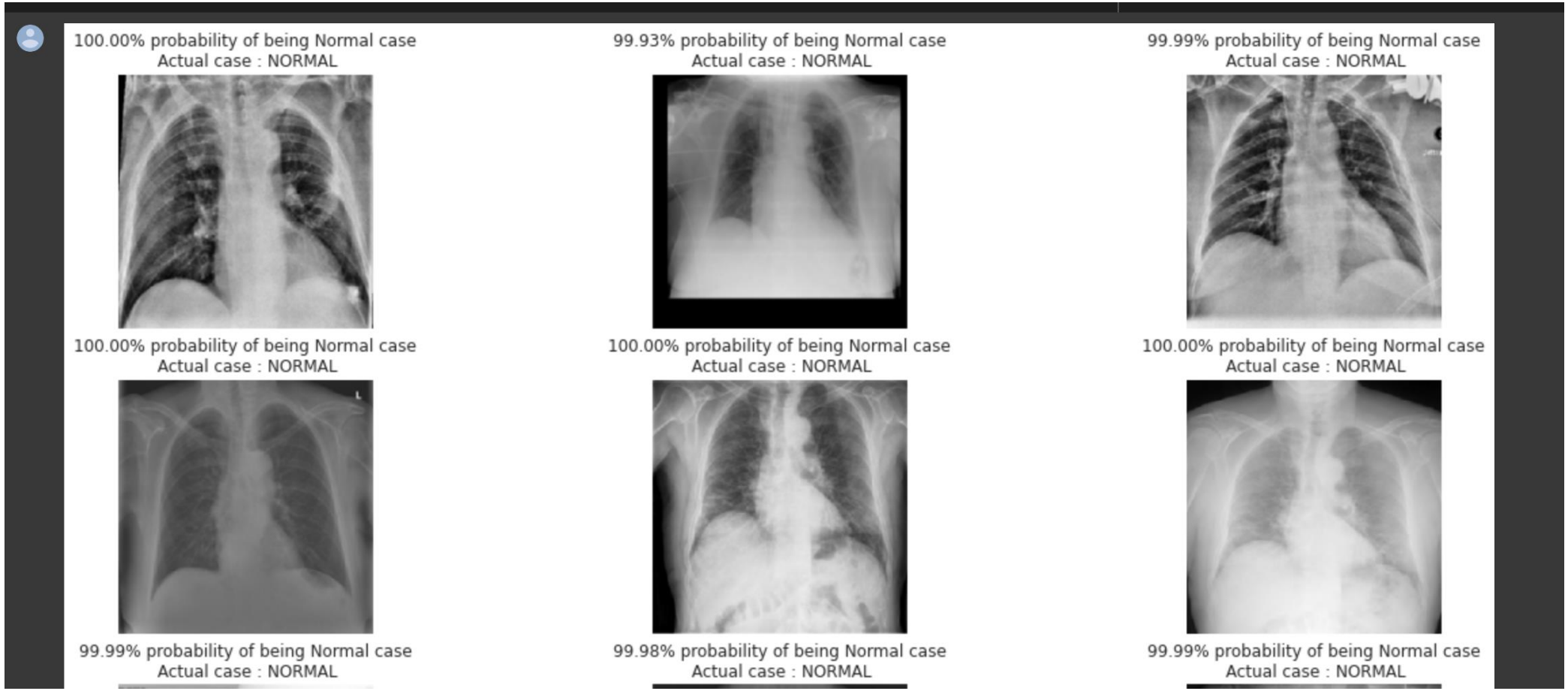
Performance results per class



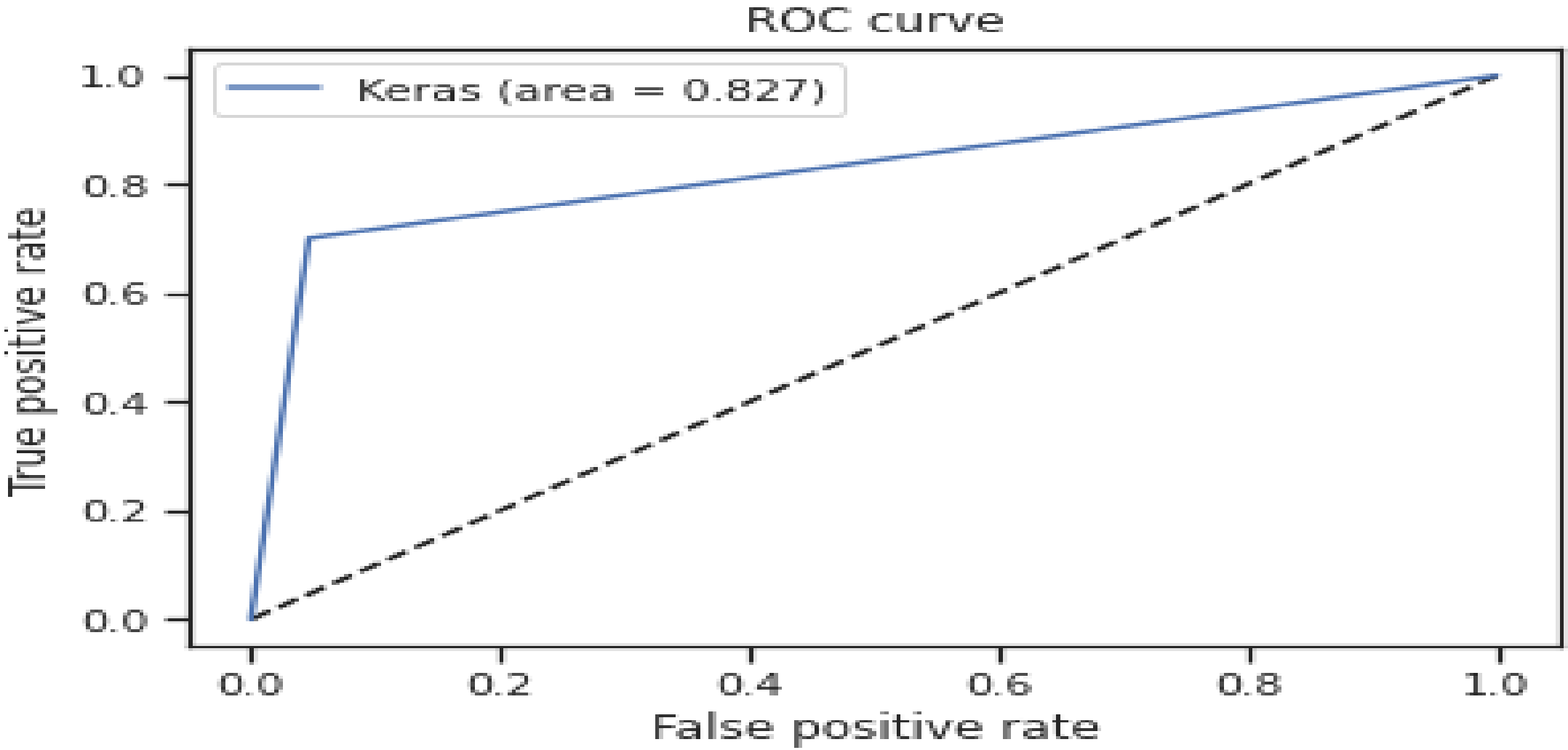




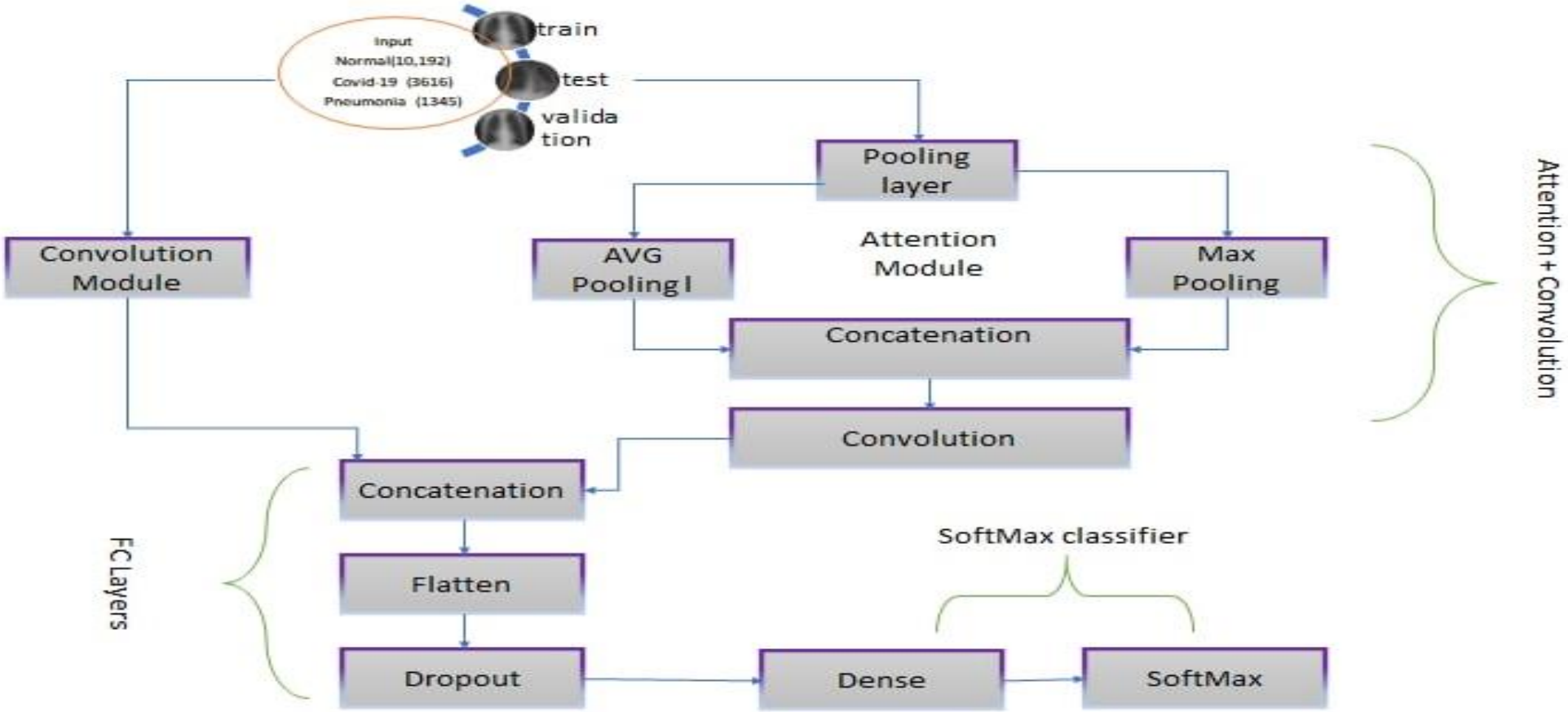
Predication/ out put



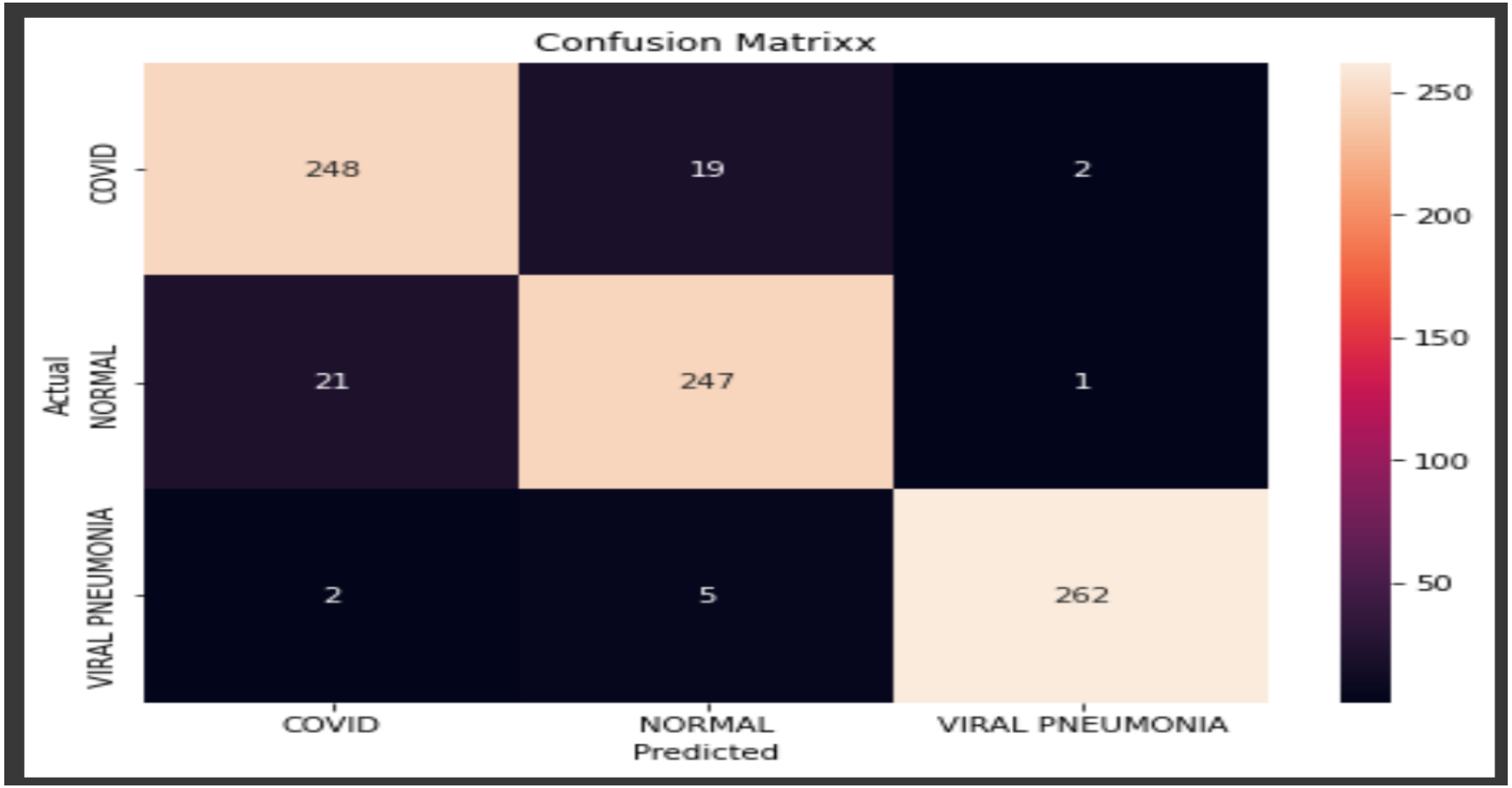
ROC curve (True positive rate vs false Positive rate)



Proposed VGG16 architecture



confusion matrix

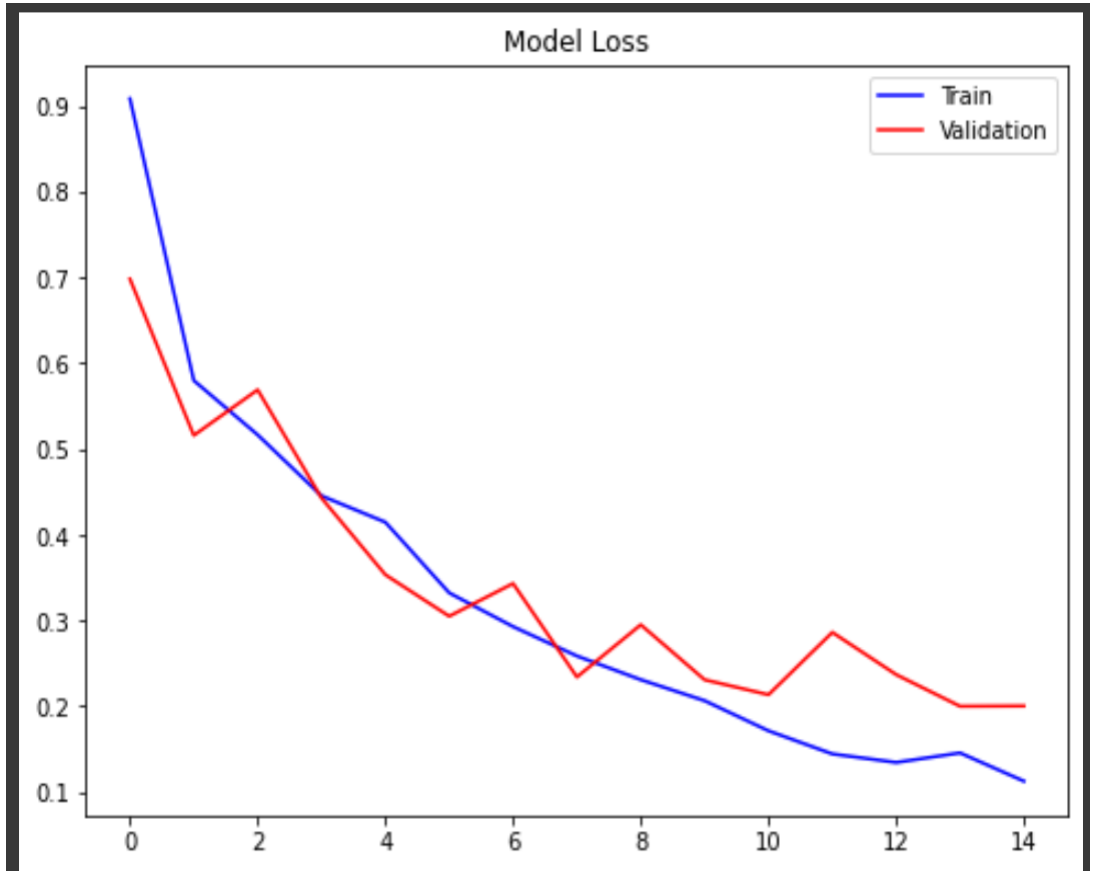


Classification report

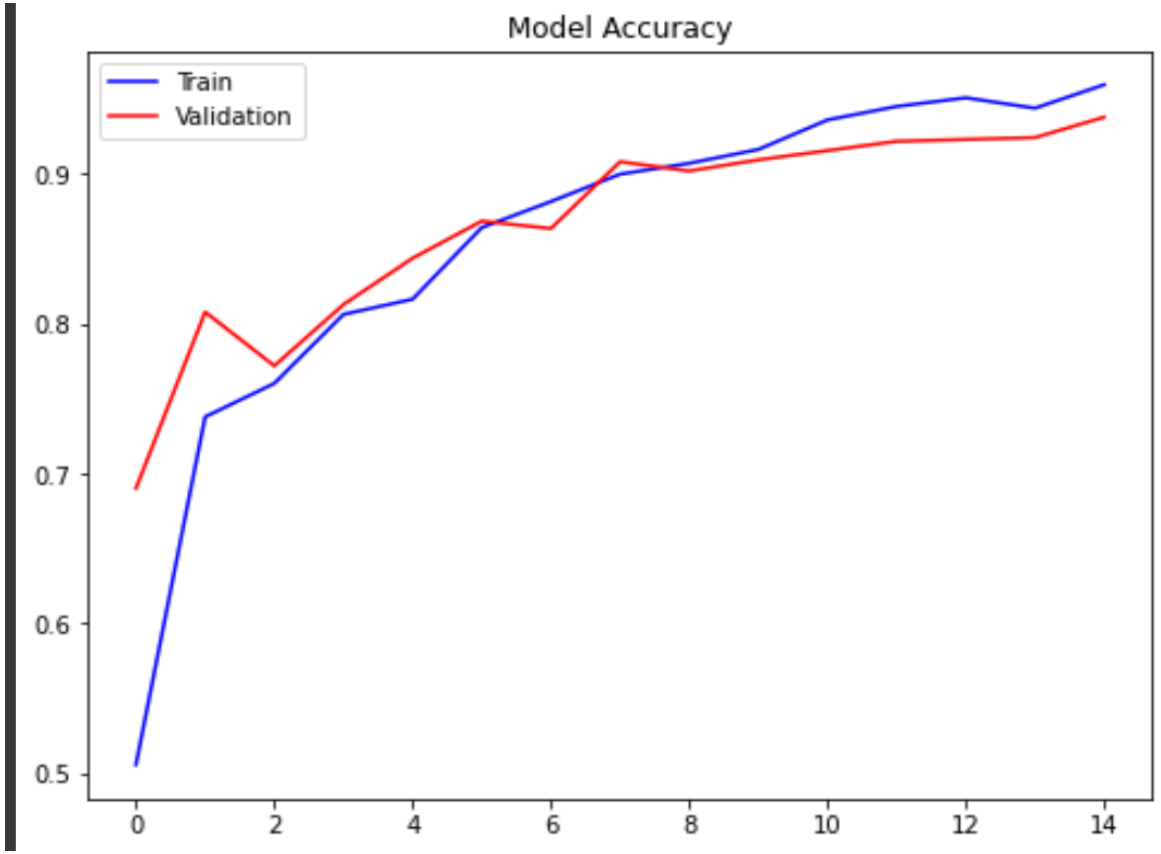
	precision	recall	f1-score	support
Covid	0.92	0.92	0.92	269
Normal	0.91	0.92	0.91	269
Viral Pneumonia	0.99	0.97	0.98	269
accuracy			0.94	807
macro avg	0.94	0.94	0.94	807
weighted avg	0.94	0.94	0.94	807

Model evaluation

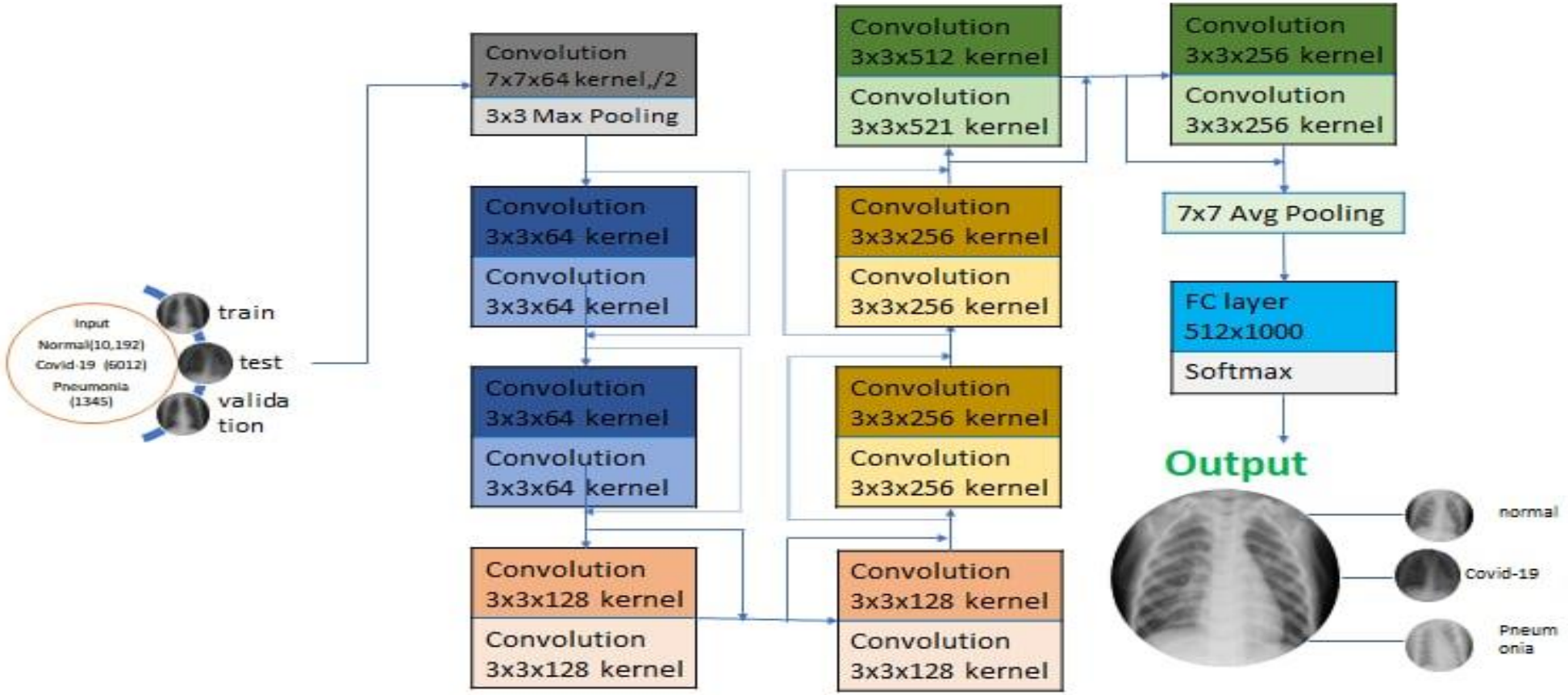
Train loss vs validation loss



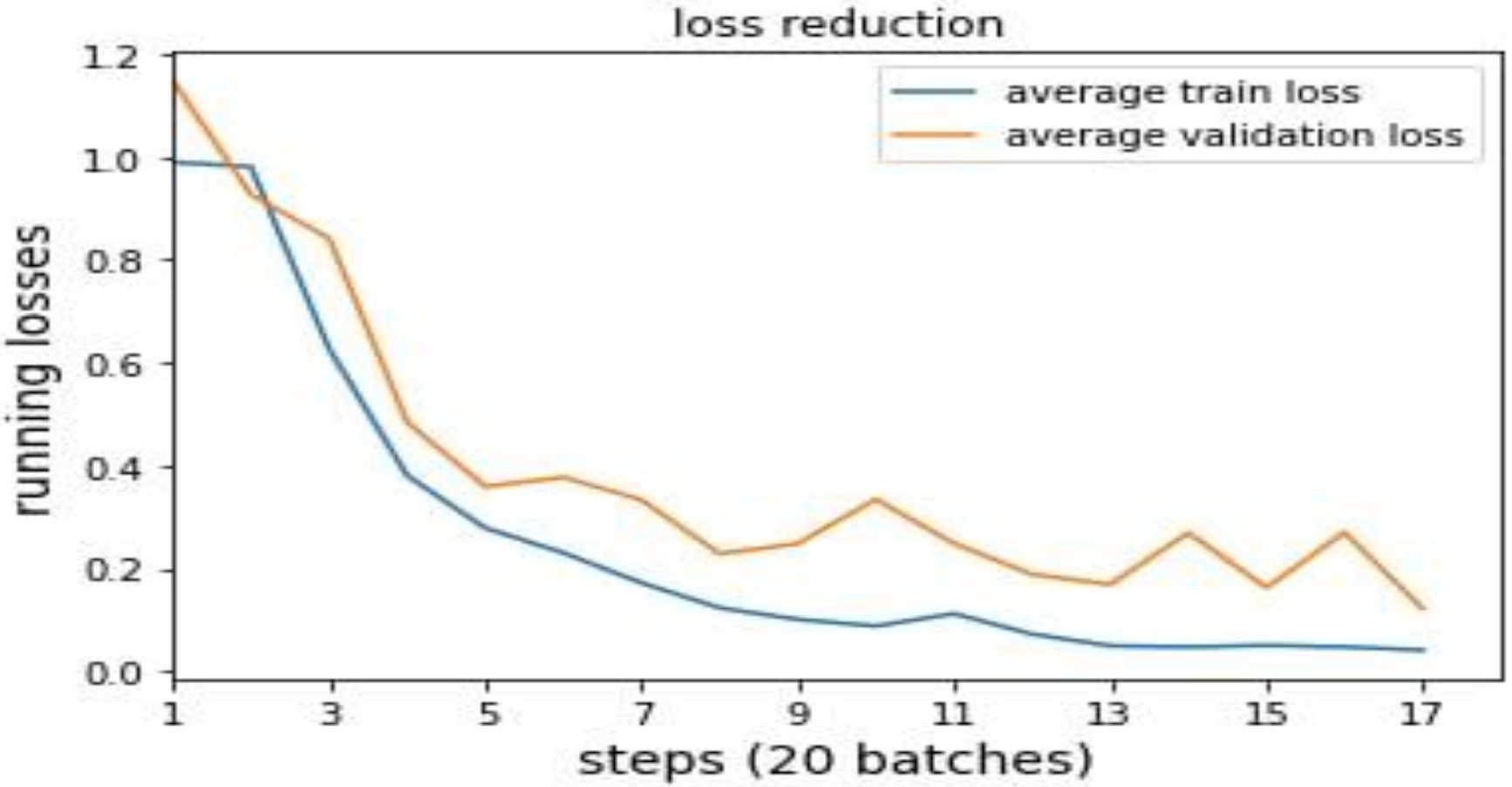
Tarin accuracy vs validation accuracy



Proposed ResNet-18 architecture



Train loss vs validation loss



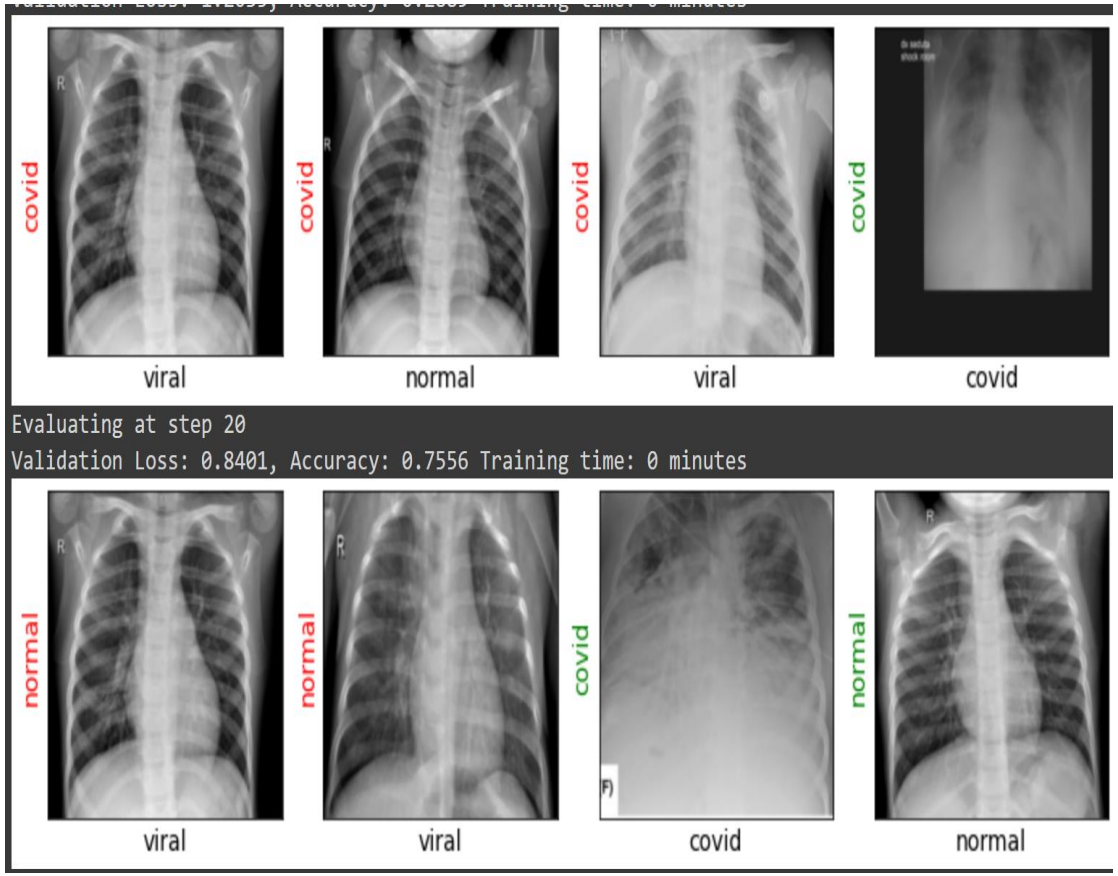
Classification report and Confusion matrix

```
1 printMetrics(results)
```

```
        - Accuracy: 94.85%
        - Precision: 94.83%
        - Recall: 94.85%
        - F1: 94.83%
[[1948    76    10     4]
 [ 104 1084     0    15]
 [    3     0   266     0]
 [    3     2     1   717]]
```

Predication/output

During training



After training