

DIAGNOSING PNEUMONIA USING DEEP LEARNING

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Why Pneumonia?

Pneumonia is the
cause of **1 out of 6**
childhood deaths,
making it the
leading cause of
fatalities in children
under 5 years

In the United States,
The death rate of pneumonia is 10 out of every
100,000 individuals



In Africa,
The death rate of
pneumonia is 100
out of every
100,000 individuals

100,000

Deaths per year due to the misdiagnosis
of pneumonia

Misdiagnosis

- *Wrongful diagnosis of pneumonia can be very life threatening given that it leads to an increase in severity due to lack of treatment. Especially in cases where the patient might have a more serious infection like COVID-19.*
- *Why so many misdiagnosis?*
 - *Such errors are caused by rushing patients through examinations especially now during the times of COVID - 19.*
 - *It can also be due to the health workers who often possess low education levels which causes them to lack the required knowledge for recognizing pneumonia.*



TREATMENT



VIRAL

Antiviral medications will be prescribed to the patient.



BACTERIAL

Antibacterial medications will be prescribed to the patient.



WALKING & CHEMICAL

Rest, antibiotics, anti-inflammatory drugs, steroids, etc.

PNEUMONIA TIME SCALE

More deadly if younger than 5
years of age or older than 65

People most-likely recover when
diagnosed and treated properly

WEEK 1

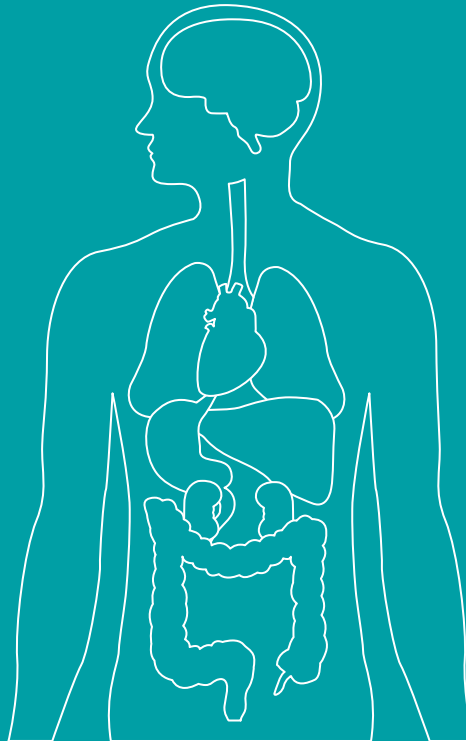
30% 

Temperature should have
reduced.

WEEK 6

70% 

cough and breathlessness should've
reduced.



WEEK 4

 50%

Mucus and chest pain should
have reduced.

WEEK 12

 90%

Most symptoms should have
subsided by now.

Using the Kaggle's Image Dataset With X-Rays of Patients who Tested Both Positive and Negative For Pneumonia



50% Chest X-Rays
showing normal lungs



TOTAL: 2,682



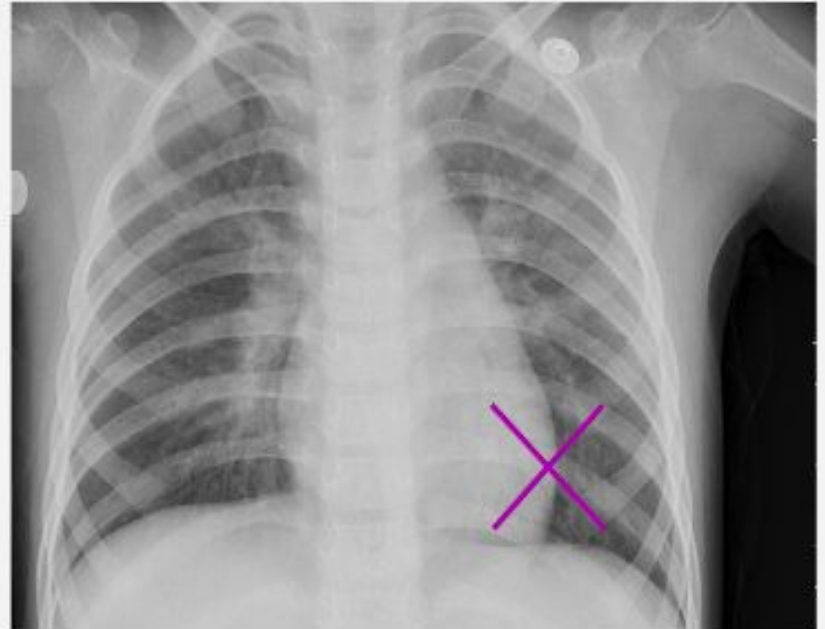
50% Chest X-Rays showing
lungs infected with Pneumonia

Physical Examination

NORMAL



PNEUMONIA



Results - Pneumonia

ACCURACY

The accuracy is **90%** and this is the amount of time the predicted result is actually correct.

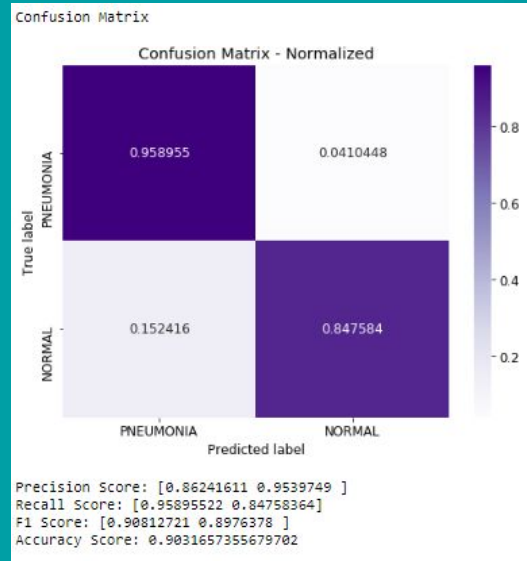
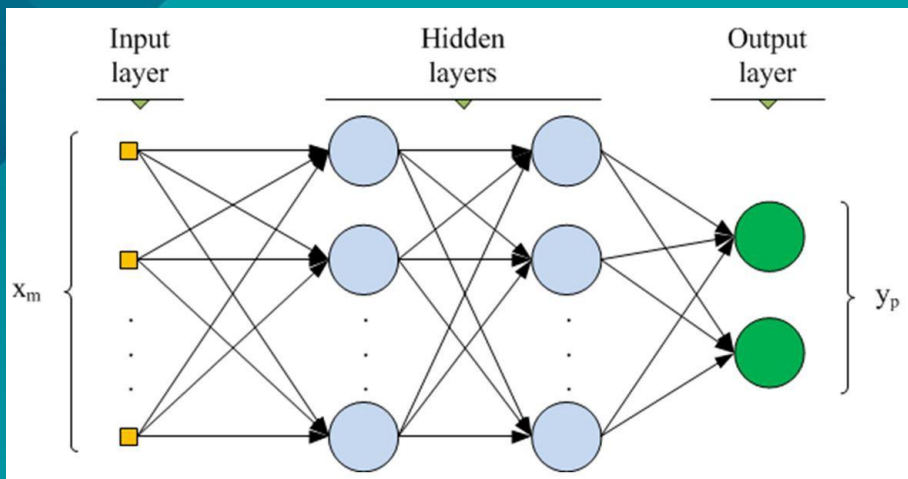
LOG LOSS

The model loss is **0.32** out and this is the amount the model penalizes for incorrect predictions.

RECALL

The recall percentage is **90%** and this is the probability of the model diagnosing a correct positive diagnosis out of all the times it diagnosed positive.

Using A Base CNN Model



Results - Pneumonia

ACCURACY

The accuracy is **95%** and this is the amount of time the predicted result is actually correct.

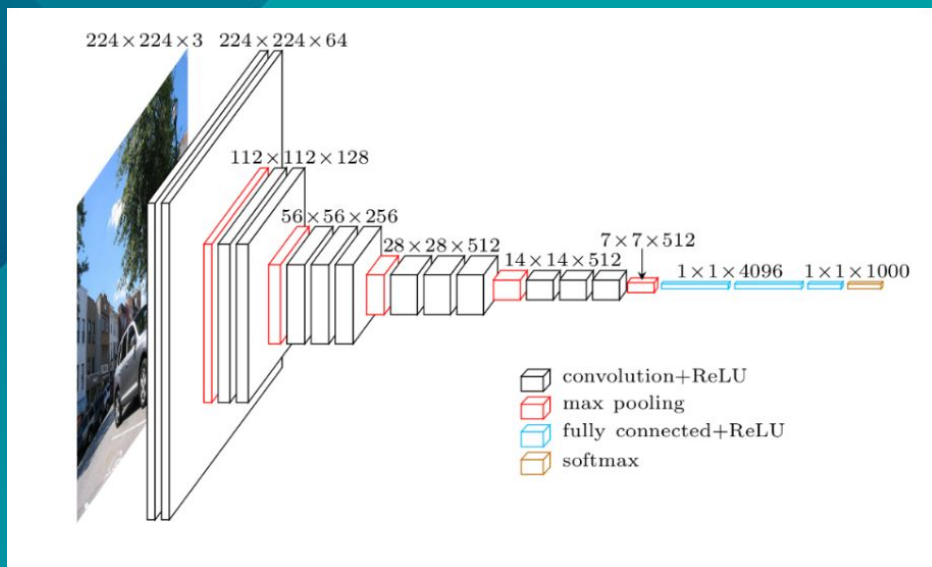
LOG LOSS

The model loss is **0.17** out and this is the amount the model penalizes for incorrect predictions.

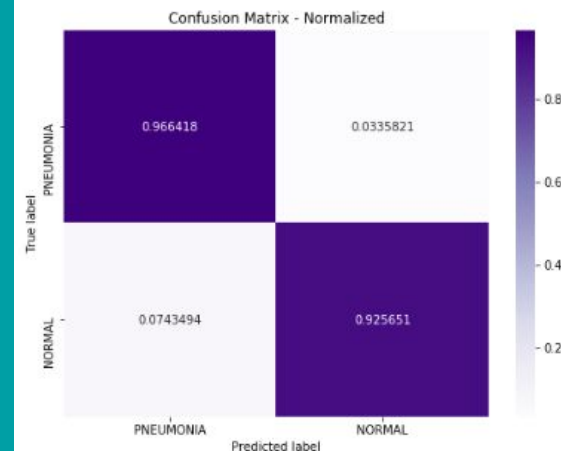
RECALL

The recall percentage is **95%** and this is the probability of the model diagnosing a correct positive diagnosis out of all the times it diagnosed positive.

Using VGG19 Transfer Learning Model



Confusion Matrix



Precision Score: [0.92831541 0.96511628]
Recall Score: [0.96641791 0.92565056]
F1 Score: [0.94698355 0.94497154]
Accuracy Score: 0.9459962756052142

Conclusion



The Pneumonia model has a recall score of 95%. It could be improved by trying different parameters but these scores are good enough as it is so Doctors and Radiologists are more than welcomed to integrate this models into their medical applications to help in the correct diagnosing of Pneumonia, after thorough verification.

Recommendation



- * Reshape the x-ray sizes to 64 x 64 to reduce the amount of computational time and power consumed when using the VGG19 model.
- * Use a MaxPooling layer before flatten the model and using a dense layer of 512 nodes and also a learning rate of 0.000800000037997961 in order to get a better performing model when using the VGG19 model.
- * Add a dropout layer before the final dense layer to dropout half of the output from the prior dense layer using 512 nodes in order to reduce overfitting when using the VGG19 model.

Future Work

Other Lung Diseases

Create a classifier to differentiate pneumonia x-rays from other lung infections like Tuberculosis, etc.



Target Detection

Create a classifier to detect what section of the lungs the infection is located.

Model Improvement

Collect more data and tune more layers to the transfer learning model to improve its performance.



THANK YOU

References

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Appendix - Pneumonia

- *The AUC score is 0.95 and this is the average probability that the model can diagnose each X-ray image correctly.*
- *The model loss is 0.17 out and this is the amount the model penalizes for incorrect predictions.*

