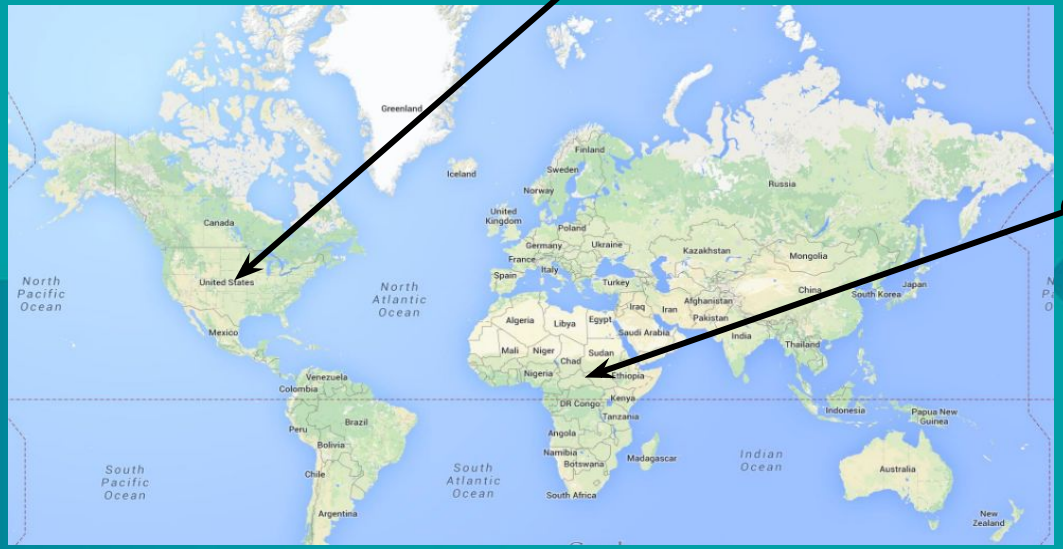
DIAGNOSING PNEUMONIA USING DEEP LEARNING

By Ari Iwunze

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

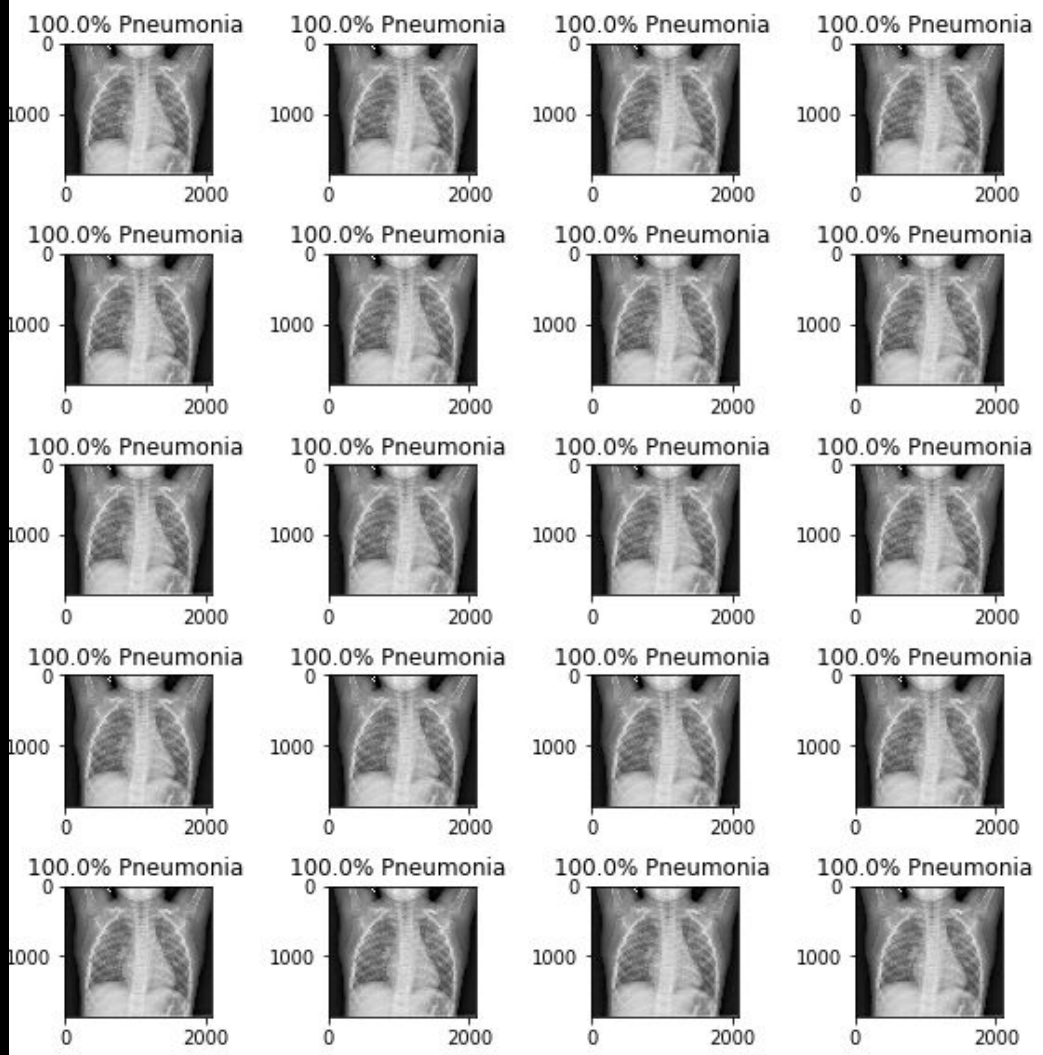
100,000

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 causes by rushing patents 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.

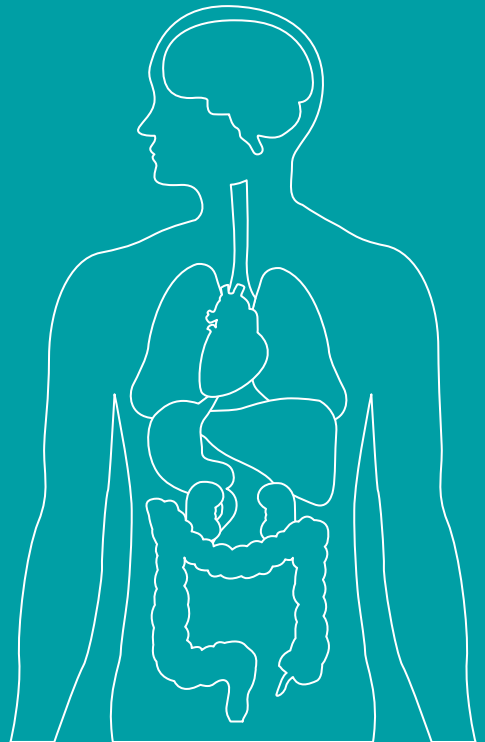
WALKING & CHEMICAL

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 4

50%

Mucus and chest pain should have reduced.

WEEK 6

70%

cough and breathlessness should’ve reduced.

WEEK 12

90%

Most symptoms should have subsided by now.

Using the Kaggle's Image Dataset With X-Rays of Patients With and Without Pneumonia

27% Chest X-Rays showing normal lungs

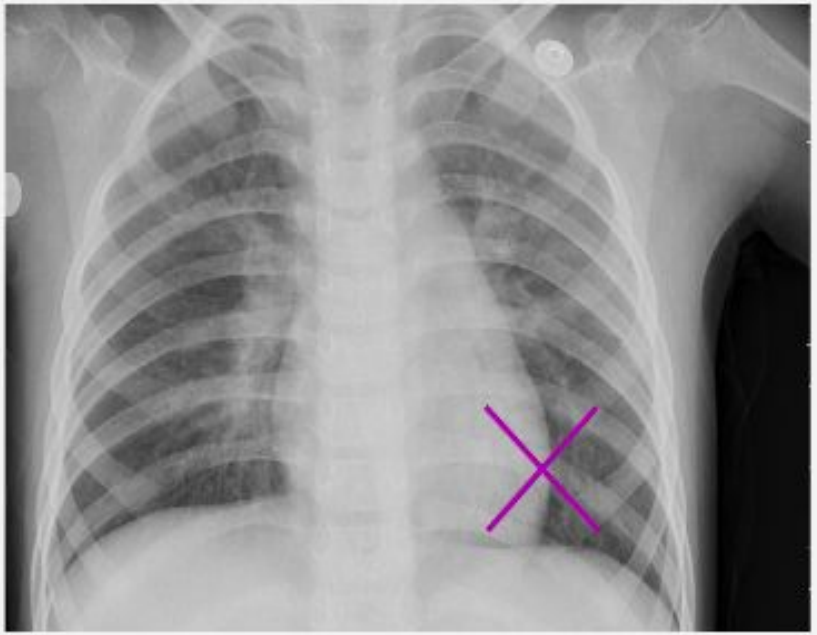
5,856 Total Chest X-Rays

73% Chest X-Rays showing lungs infected with pneumonia

Physical Examination

NORMAL

PNEUMONIA



Results

ACCURACY

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

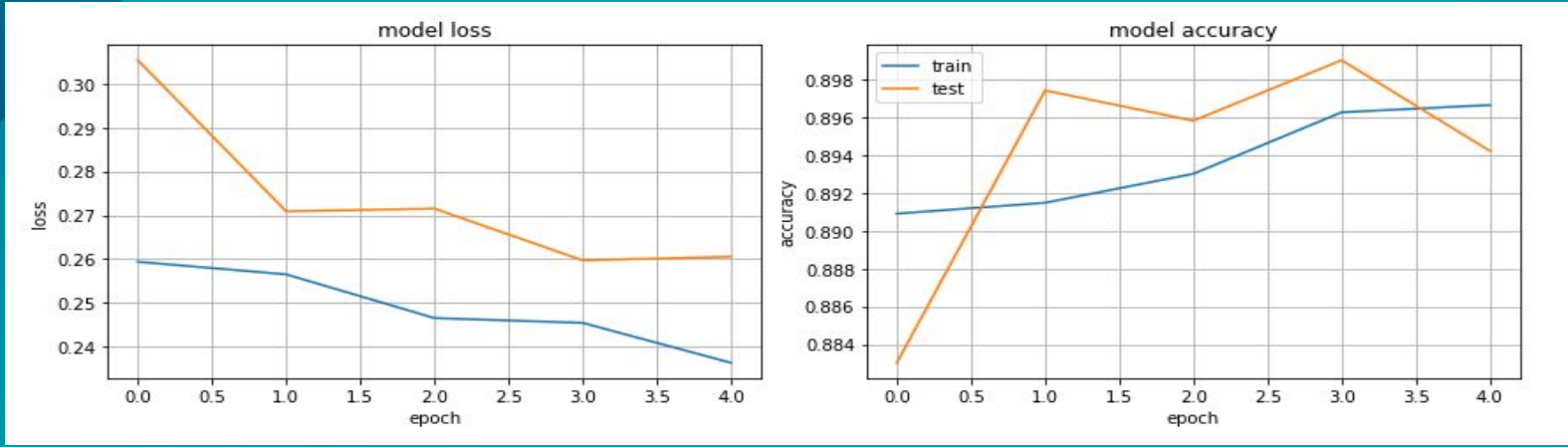
LOG LOSS

The model loss is 0.2 out and this is the amount the model penalizes for incorrect predictions ~ 10%

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 The VGG16 Transfer Learning Model



Future Work

Other Lung Diseases

Create a classifier to differentiate pneumonia x-rays from other lung infections like COVID-19, 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.

Conclusion



Our model has a recall score of 90%. Let’s help save lives lost to pneumonia so we can allocate more resources to other health related problems.



Health professionals are welcomed to integrate this model, after thorough verification, into their medical software to help them correctly diagnose pneumonia.

THANK YOU

References

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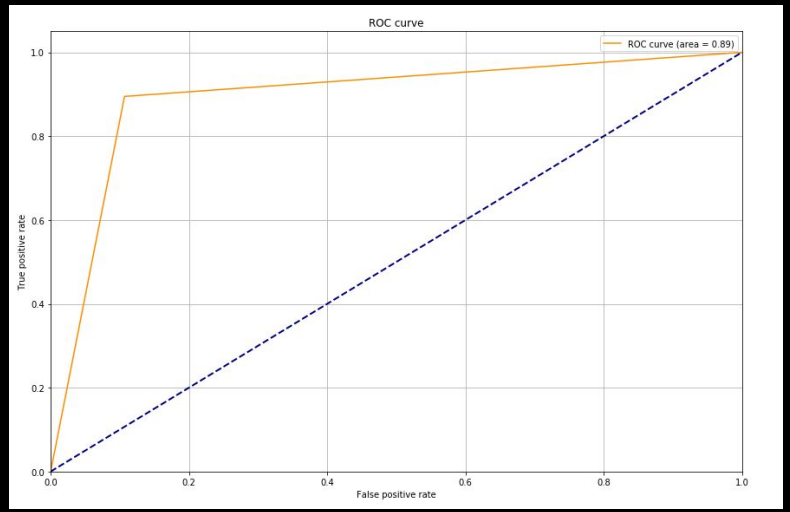
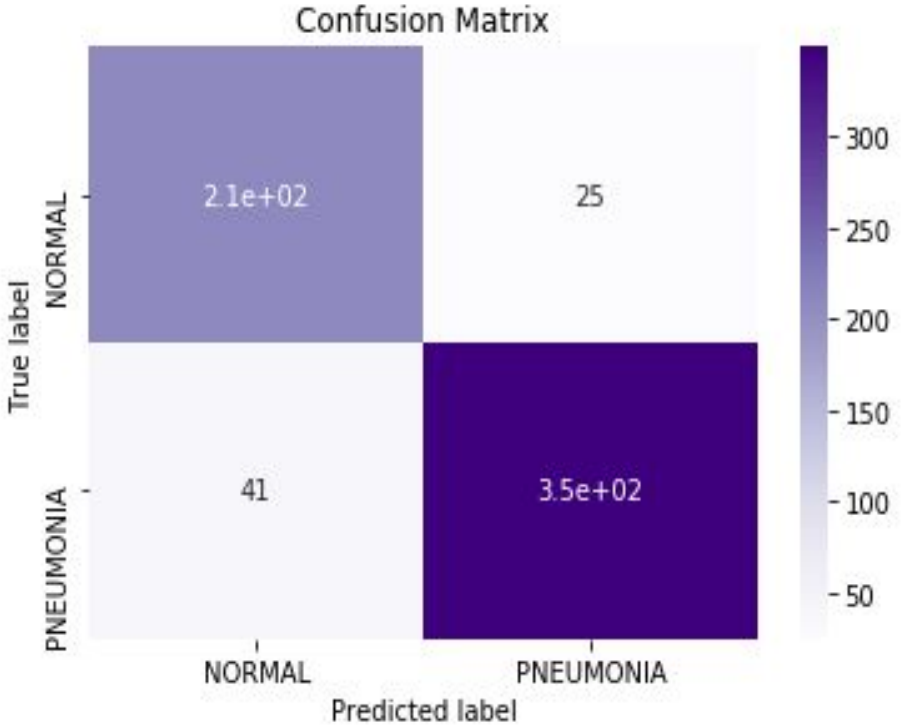
Appendix

- ***The AUC score is 0.89 and this is the average probability that the model can diagnose each X-ray image correctly.***

- ***The model loss is 0.2 out and this is the amount the model penalizes for incorrect predictions ~ 10%***



Confusion Matrix



Precision Score: 0.9331550802139037
Recall Score: 0.8948717948717949
Accuracy Score: 0.8942307692307693
F1 Score: 0.9136125654450262