



Identifying Pneumonia From X-Rays

Using Convolutional Neural Networks

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Overview

- Pneumonia is a serious lung infection that disproportionately affects the young, the elderly, and the immunocompromised.
- It is the leading cause of death among children under the age of 5.
- USA has shown negligible improvements in decreasing the death rate from pneumonia over the last half century even as antibiotics have become much more prevalent.



Problems to solve



1

How accurately can we detect pneumonia in patients from a simple X-ray scan?

2

What are the most common signs in an X-ray scan that indicate possible presence of pneumonia?

3

Can our model be a better and more convenient predictor than medical tests?

4

Using our model, can we decrease the number of pneumonia related fatalities?

The Data

kaggle™



5,865 Images

jupyter

colab

Train

Validation

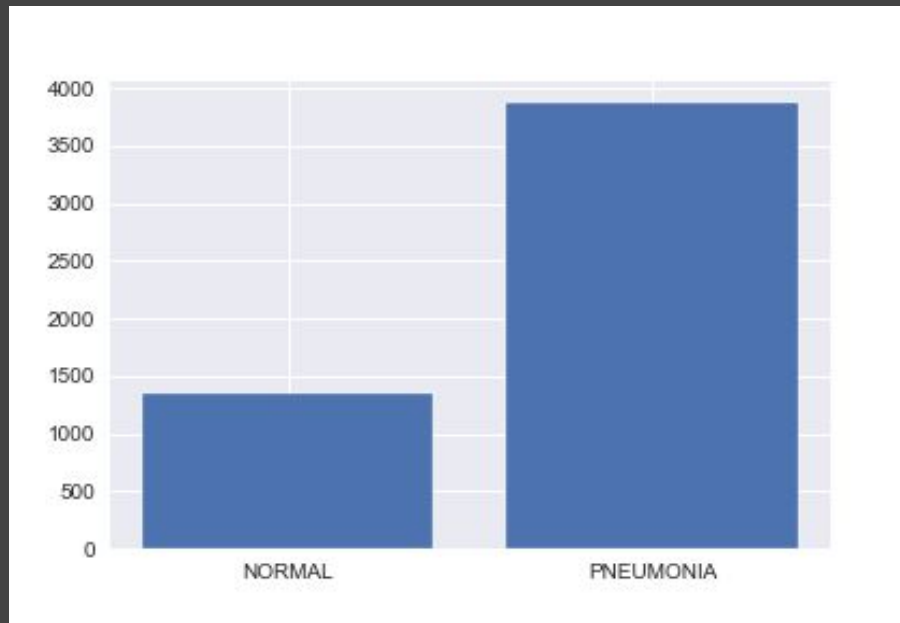
Test

Normal

Pneumonia

Class Imbalance

- Our data was highly imbalanced with a ratio of 1:3
- Contrary to a real-world scenario, our majority class was the patients with pneumonia
- We need to keep this in mind for our evaluation metrics.



EDA



NORMAL



NORMAL



NORMAL



NORMAL



NORMAL



PNEUMONIA



PNEUMONIA



PNEUMONIA



PNEUMONIA

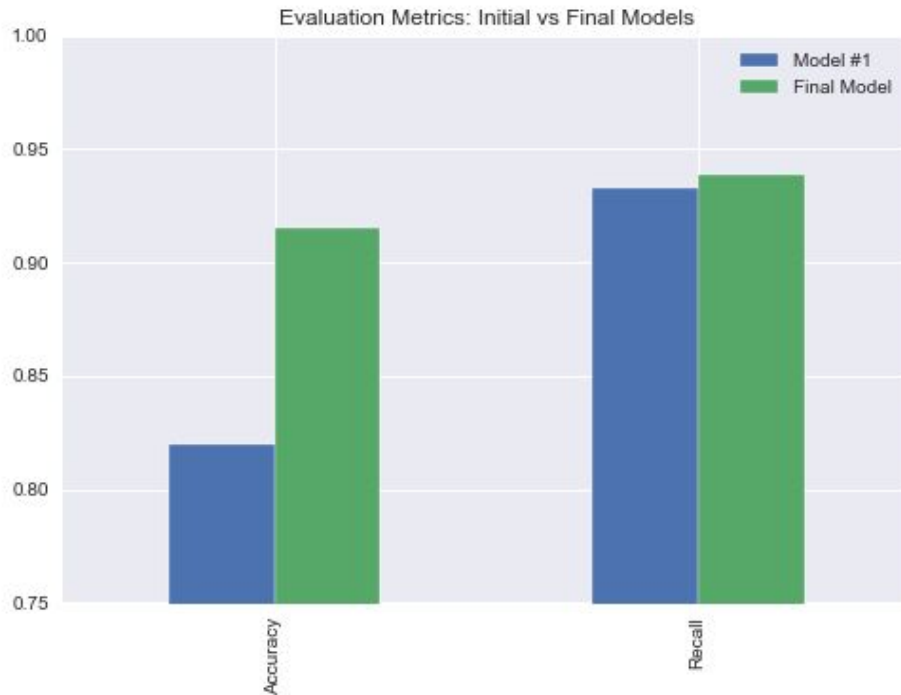


PNEUMONIA



Evaluation Metric

- We used **Recall** as our target evaluation metric .
- We wanted to correctly classify the maximum number of patients who end up with pneumonia .
- We also looked at **Accuracy** because we had a high imbalance towards the positive, which meant we could easily have 100% recall without having good accuracy overall.



Modelling Process



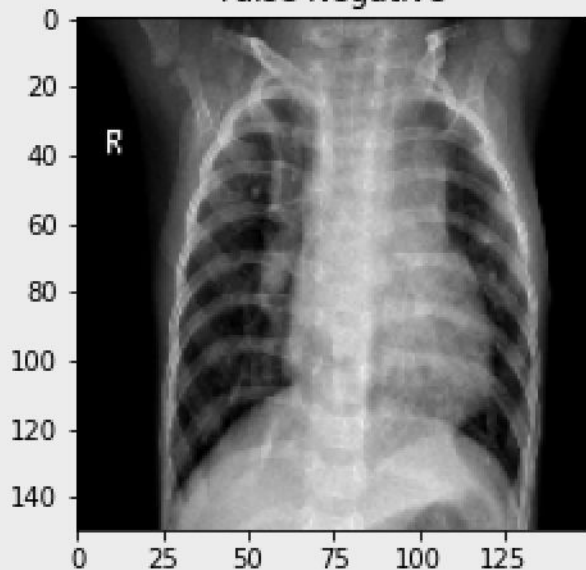
<i>Model #</i>	<i>Convolution & Max Pooling Layers</i>	<i>Dropout Layers</i>	<i>Data Augmentation</i>	<i>Optimizers</i>
One	1	0	No	Sgd
Four	4	2	No	Adam
Seven	4	3	Yes	Adam
Final	3	0	Yes	AdamW

Evaluation (continued)

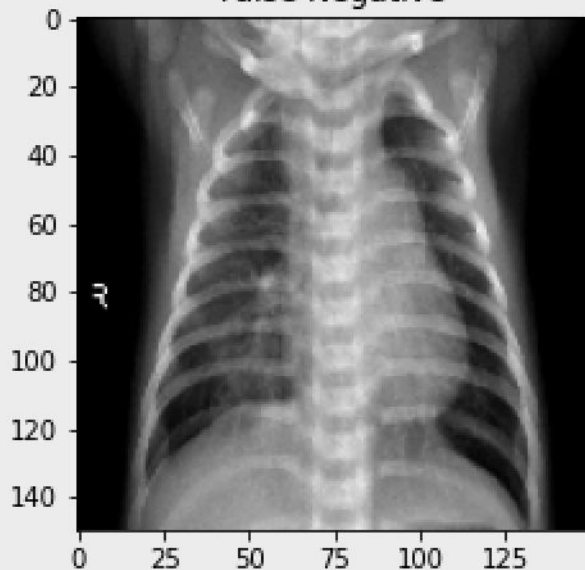


Analyzing Incorrect Predictions

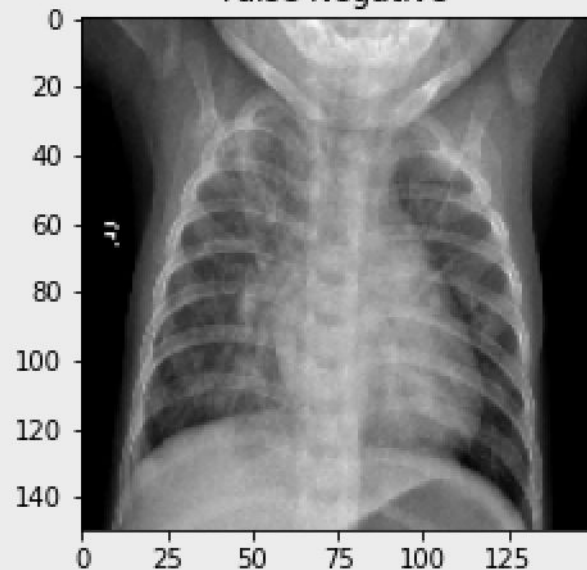
False Negative



False Negative

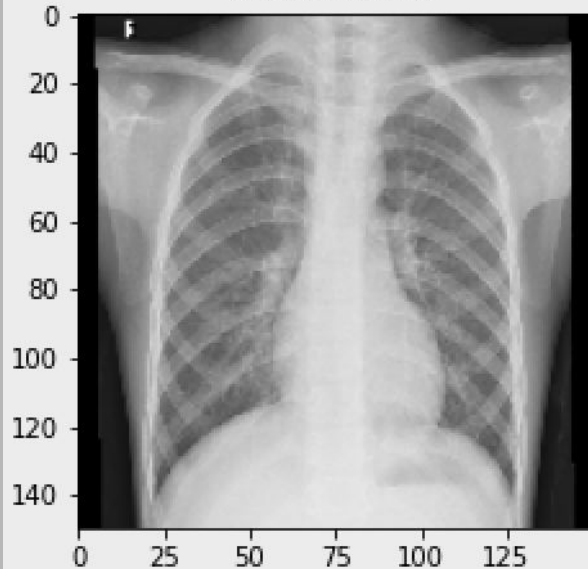


False Negative

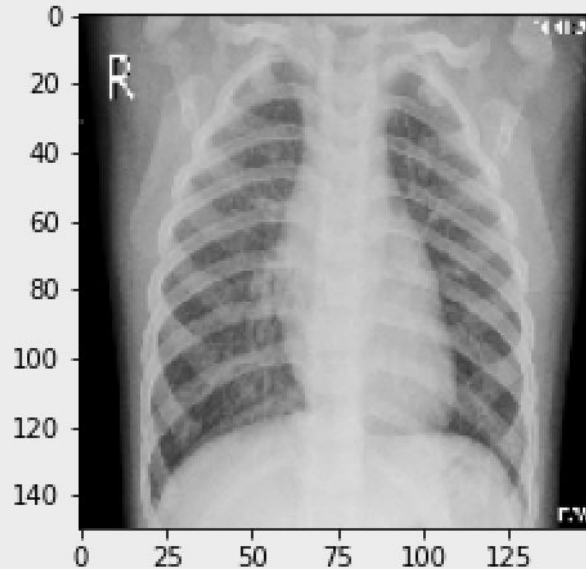


Continued - Analyzing Incorrect Predictions

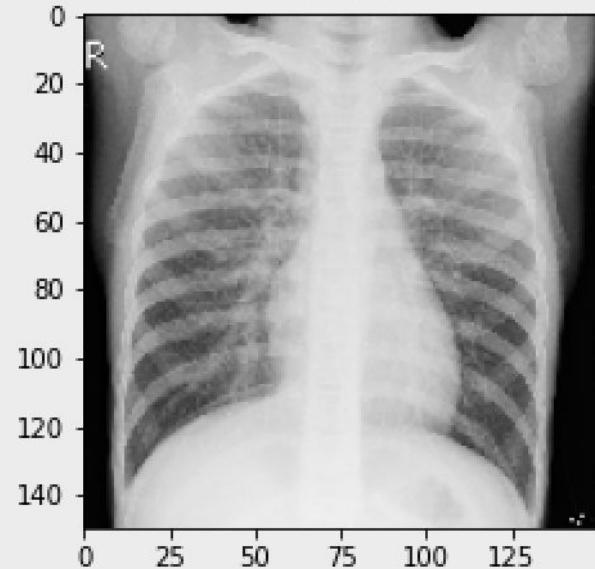
False Positive



False Positive



False Positive



Future Work:

- In reality, X-ray scans are not ideal for detecting pneumonia. We can use CT scan images as the data next time.
- We were limited by our system in constructing the architecture of the models. Using a faster runtime, we can increase epochs, batch sizes and other parameters to get more complex models.
- We can implement transfer learning as our following measure.
- We can visualize the activation and intermediate layers of our models to see how it may be recognizing patterns.



Thank you.

