Pneumonia Detection

Mod 4

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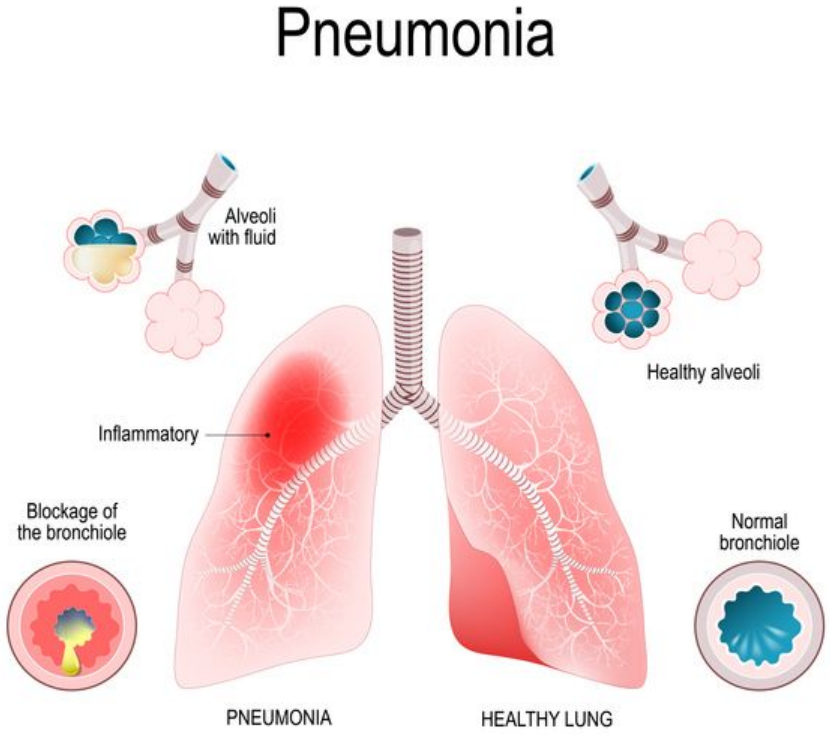
Goal

- Build a deep learning model that can classify whether a given patient has pneumonia, given a chest x-ray image.
- Put the model to production.

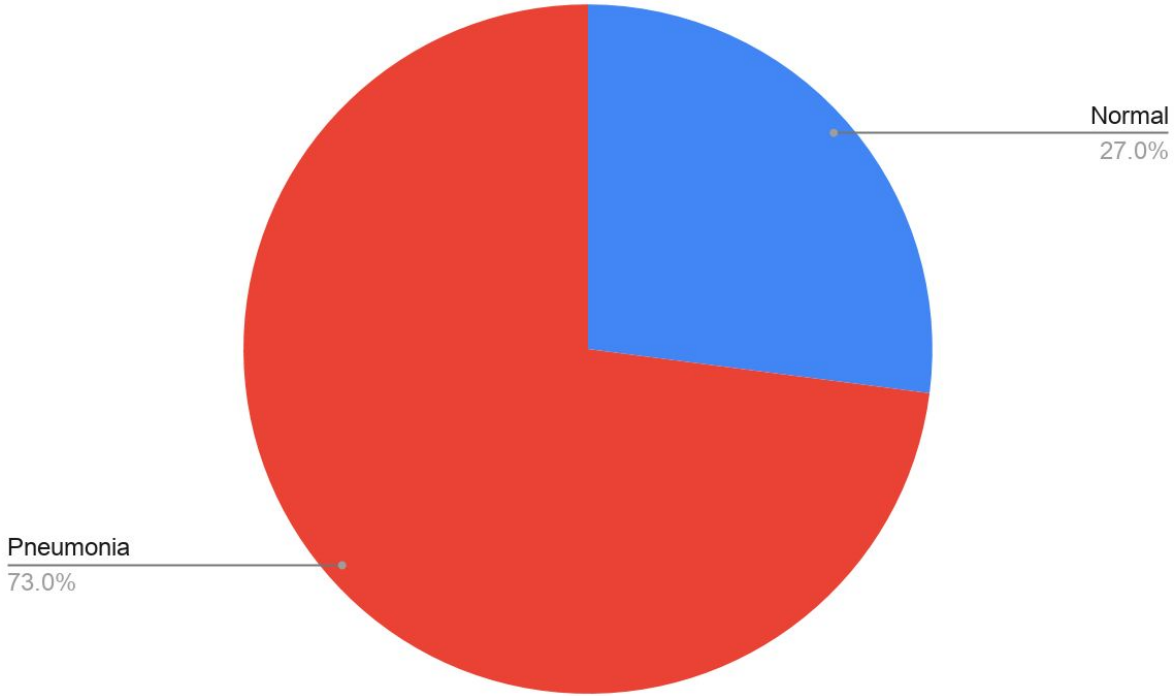
What is Pneumonia?

Pneumonia is an inflammatory condition of the lung affecting primarily the small air sacs known as alveoli.

Symptoms typically include some combination of productive or dry cough, chest pain, fever and difficulty breathing.



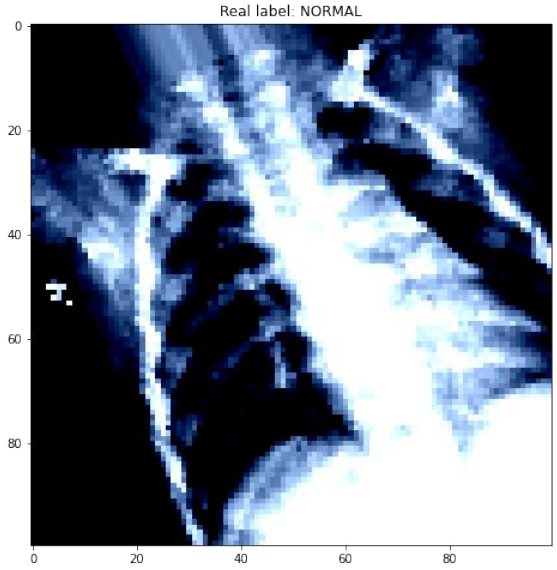
DATA

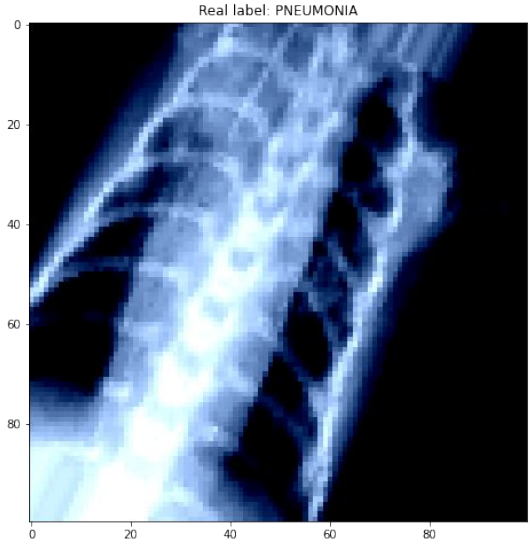


5857 Total Images

Preprocessing images

- Some images were in grayscale and majority of them were in 3-channels, hence converted all images to 3-channels.
- Normalize pixel values, resize all images to 224x224 size.
- Data Augmentation(imgaug): Generate samples of undersampled class to try and balance overall distribution.





Models

- Convolutional Neural Network
- Transfer learning (VGG16 architechture)

Working model in progress..

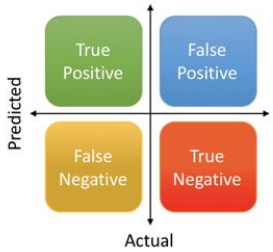
Results (CNN)

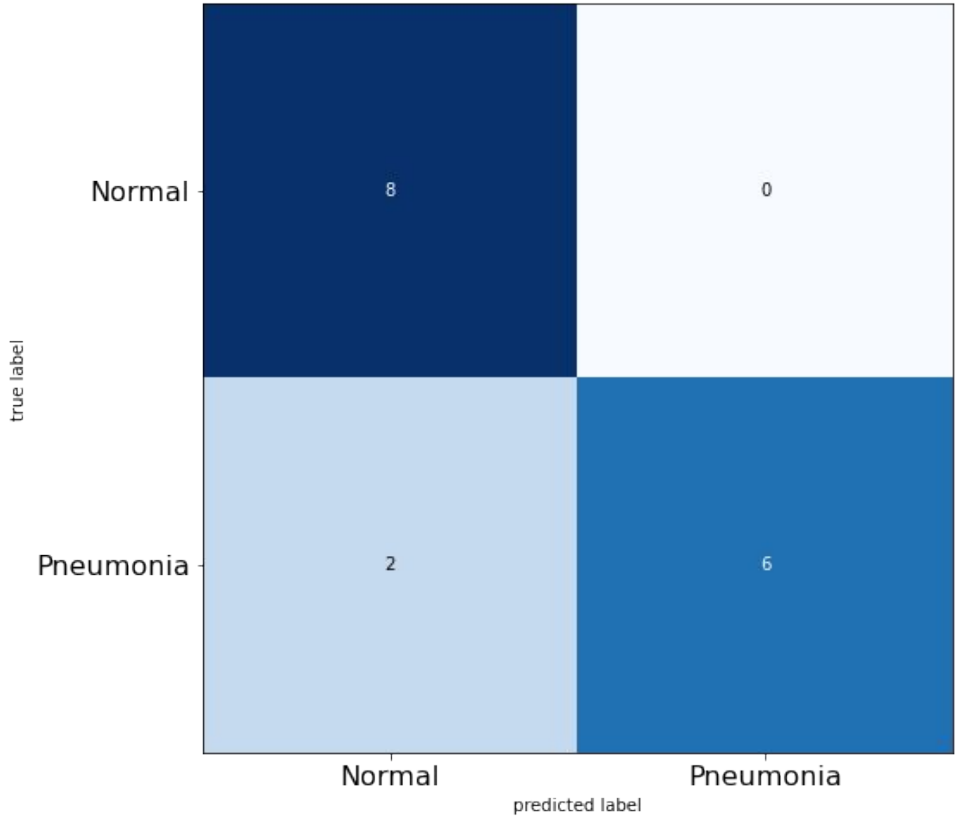
Accuracy: 87.5 %
Precision: 75%
Recall: 100%
F1 score: 85%

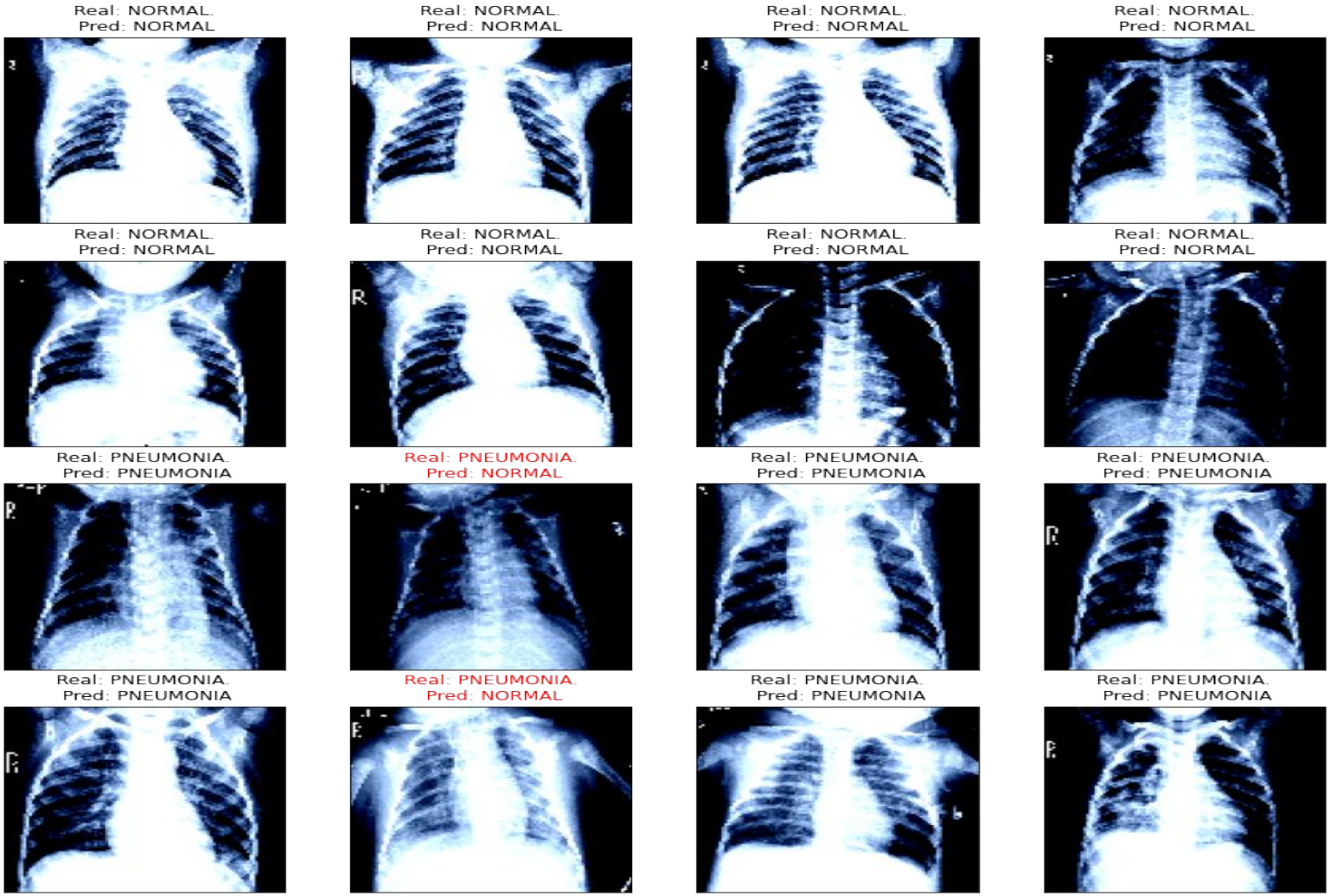
Precision = $\frac{\text{True Positive}}{\text{Actual Results}}$ or $\frac{\text{True Positive}}{\text{True Positive + False Positive}}$

Recall = $\frac{\text{True Positive}}{\text{Predicted Results}}$ or $\frac{\text{True Positive}}{\text{True Positive + False Negative}}$

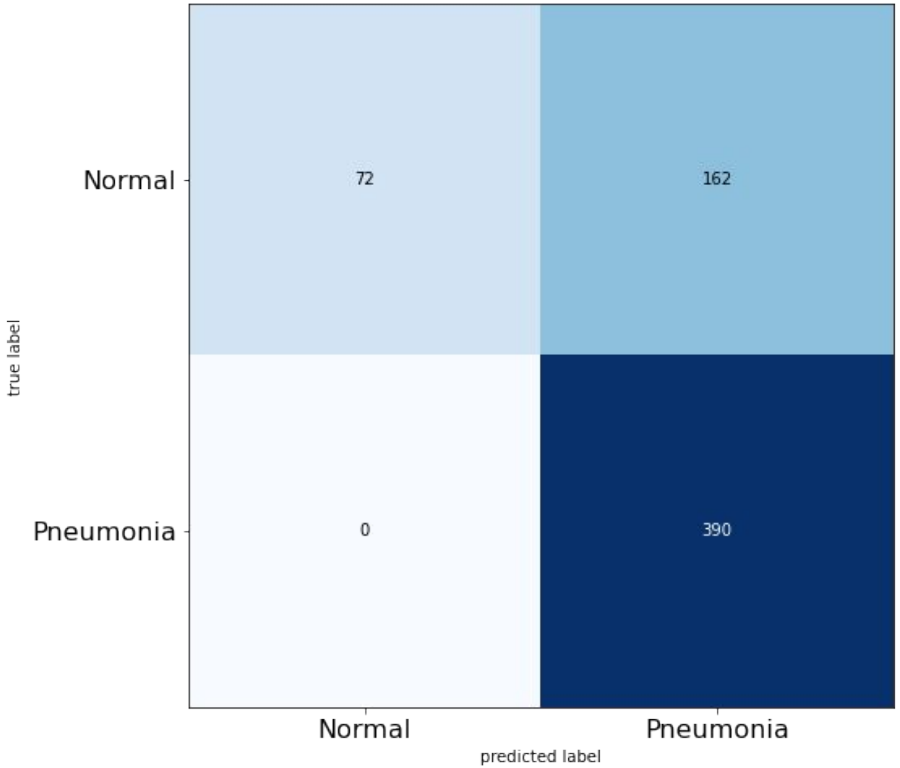
Accuracy = $\frac{\text{True Positive + True Negative}}{\text{Total}}$






Real: NORMAL.
Pred: NORMAL
Real: NORMAL.
Pred: NORMAL
Real: NORMAL.
Pred: NORMAL
Real: NORMAL.
Pred: NORMAL
Real: NORMAL.
Pred: NORMAL
Real: NORMAL.
Pred: NORMAL
Real: NORMAL.
Pred: NORMAL
Real: NORMAL.
Pred: NORMAL
Real: PNEUMONIA.
Pred: PNEUMONIA
Real: PNEUMONIA.
Pred: NORMAL
Real: PNEUMONIA.
Pred: PNEUMONIA
Real: PNEUMONIA.
Pred: PNEUMONIA
Real: PNEUMONIA.
Pred: PNEUMONIA
Real: PNEUMONIA.
Pred: NORMAL
Real: PNEUMONIA.
Pred: PNEUMONIA
Real: PNEUMONIA.
Pred: PNEUMONIA

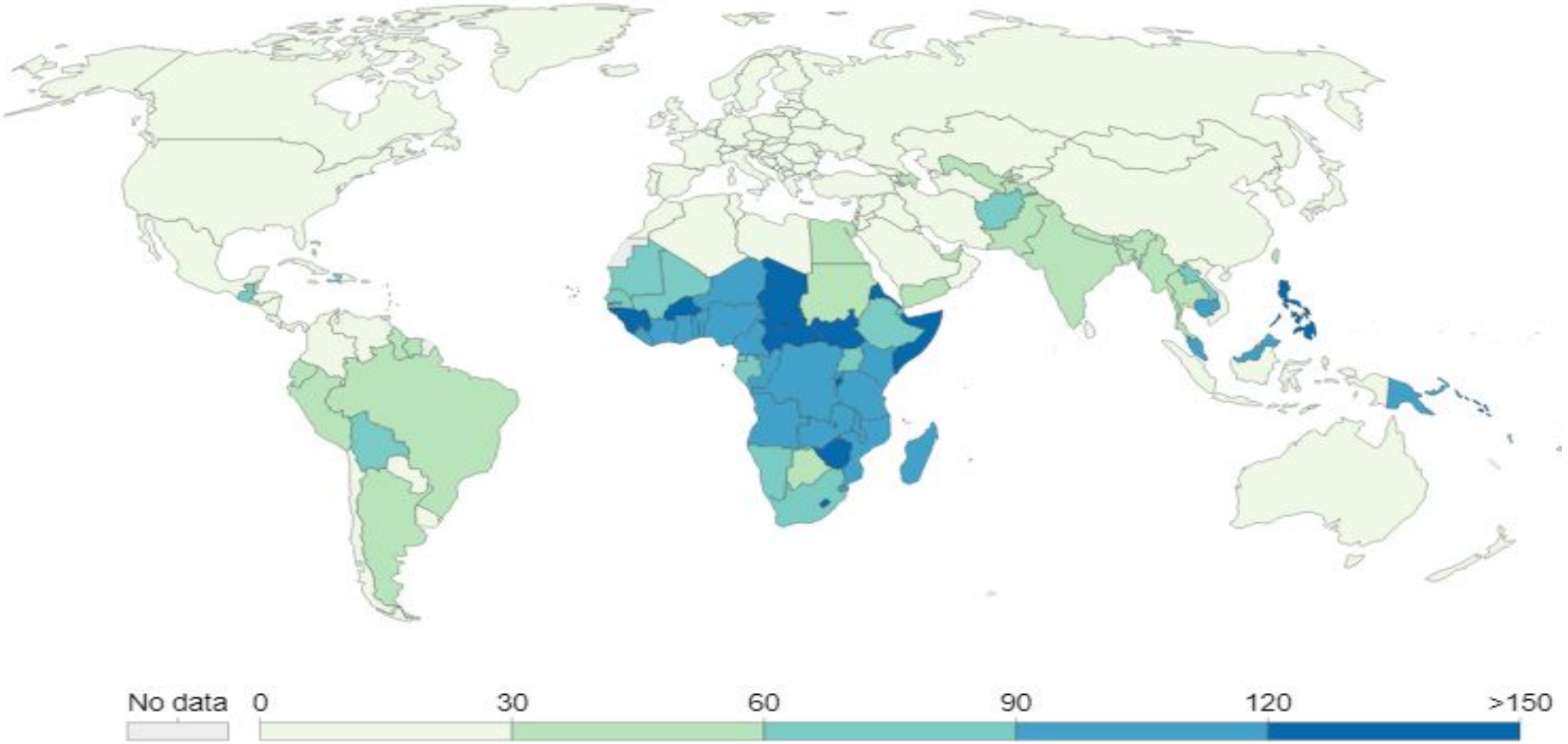
Results (Transfer Learning - VGG16)



Accuracy: 0.740385
Precision: 1.000000
Recall: 0.706522
F1 score: 0.828025

Death rate from pneumonia, 2017

The annual number of deaths from pneumonia per 100,000 people.



Why is this model important?

- Over 150 million people get infected with pneumonia on an annual basis especially children under 5 years old .
- In such regions, the problem can be further aggravated due to the lack of medical resources and personnel.
- For example, in Africa’s 57 nations, a gap of 2.3 million doctors and nurses exist. For these populations, accurate and fast diagnosis means everything. It can guarantee timely access to treatment and save much needed time and money for those already experiencing poverty.

Future Work

- If pneumonia detected, further classify if viral or bacterial pneumonia.
- Complete the flask production application for the model.
- Improve current model.
- Explore capsule network classification.
- Use deep learning for COVID-19 detection using Darknet-19 model.

THANK YOU