

## Background

Pneumonia is an infection that inflames the air sacs in one or both lungs. The air sacs may fill with fluid or pus (purulent material), causing cough with phlegm or pus, fever, chills, and difficulty breathing. A variety of organisms, including bacteria, viruses and fungi, can cause pneumonia. It can range in seriousness from mild to life-threatening. It is most serious for infants and young children, people older than age 65, and people with health problems or weakened immune systems.

## Problem

The process of diagnose pneumonia has two stage primally stage in which doctor tend to listen from the patient after doctor being satisfied with the symptoms mentioned by the patient are the ones of pneumonia the patient should go and take X-ray image and analysis of it will determine whether the patient is positive or negative.

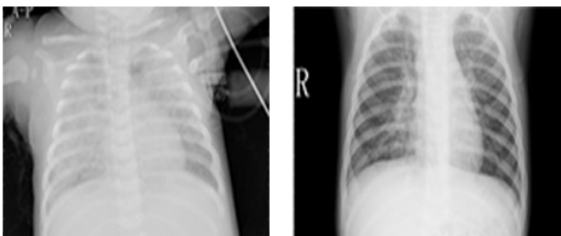
Challenge is that the radiologist takes more than 4 hours to analyze single image of chest X-ray that means it take 4 up to five 5 patients a day, if there are many should wait until the other day?

However, we can get very fast expert since he/she were around but keep in your mind that the interpretation are done by naked eyes accompanied by the level of experience of the doctor ,here is were another problem arise what if the doctor interpretation were biased it can cause more disaster further-more can cause death of the patient. In case there is the accurate expert we were capable of saving this too.

## Solution

We intend to reverse the system and diagnose hundreds patients a day by increase the rate of diagnosis since once the X-rays image is captured the output of diagnose can be done in a second by passing that image to expert system to bring them with output of the image interpretation whether its positive or negative in fraction of second.

## Data & Data pre processing



We are using dataset created from chest X-ray images sample. Images in the dataset were then annotated by a domain expert. The dataset contains two labels which are pneumonia and normal. The normalization and augmentation of the image to increase more number of images in the data set blurring the images and contrast change

## Model

We use the transfer Learning which is the way of using the better pre-trained models (state of art) these are the models which trained in the large amount of data of different class (more than a thousand classes) (ImageNet ) like Resnet, VGG to extract the features from earlier layer and train classifier on top of it. This is done by removing the last layer and replace it with the new layer with two classes whether pneumonia or normal. Then we freeze the other layer of the network by using the earlier weights train the network on the new dataset.

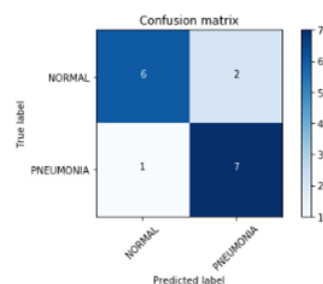
## Results & Analysis

We trained our model in different architecture from resNet18, resNet 152, resNet50 and VGG in which this experiment the res-Net50 architecture seems to outperform the rest of experiment by having the accuracy of 0.94 under Adam optimizer and cross Entropy loss function.

Performance metrics

model	Accuracy	Sensitivity	Specificity	f1-score
ResNet18	0.892	0.891	0.889	0.891
<b>ResNet50</b>	<b>0.942</b>	<b>0.932</b>	<b>0.946</b>	<b>0.943</b>
ResNet 152	0.915	0.909	0.912	0.913
VGG32	0.871	0.868	0.869	0.872

Evaluation of the model done by using confusion matrix in which it has surprisingly results in which in 18 images from the data set only 3 image are misclassified and others specifying correctly.



## Future works

We intent to collect more data and processing them by applying augmentation techniques to increase more data and fine tuning with different parameters to obtain the maximum or better accuracy in the near future.