Visual Scan Recognition

How AI can read images for pneumonia

By Arash Peimani
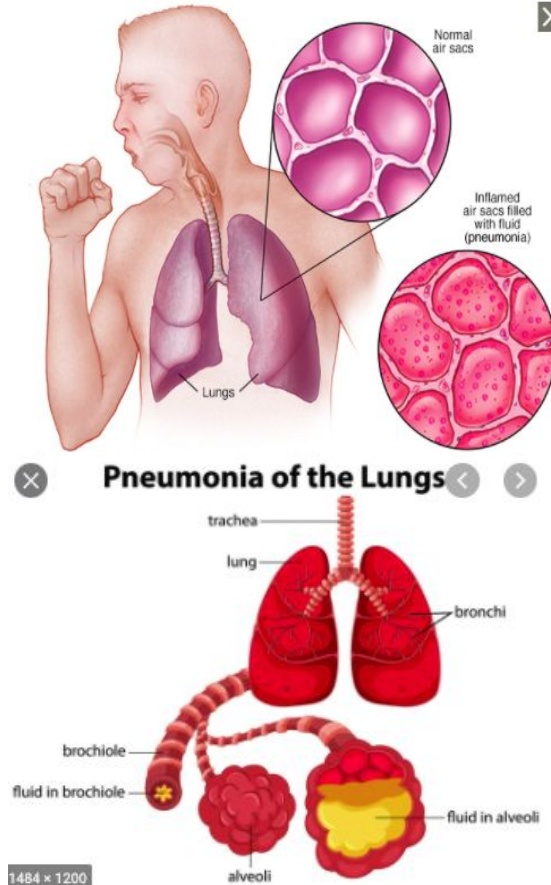
The problem

Pneumonia

Pneumonia is an infection that inflames the air sacs in one or both lungs.

Causes Include:

- Flu Viruses
- Cold Viruses
- RSV Viruses (age 1 or younger
- Bacteria (streptococcus pneumoniae and mycoplasma pneumoniae)

Normal air sacs

Inflamed air sacs filled with fluid (pneumonia)

Lungs

Pneumonia of the Lungs

trachea

lung

bronchi

brochiole

fluid in brochiole

fluid in alveoli

alveoli

1484 × 1200

Tests

- Blood Tests - bacterial infections
- Chest X-ray - to see the spread in the lungs
- Pulse Oximetry - level of oxygen in your blood
- Sputum Test - check the fluids in lungs for cause of infection

Imaging to Diagnose

- **Imaging is a very common non-invasive test.**
- **Imaging shows inflammation which shows up as white areas in the lung.**
- **The location of the infection allows for classification of type Pneumonia**

Hospitalization If:

- Older than 65
- Confusion
- Rapid Breathing
- Heart rate below 50
- Heart rate above 100
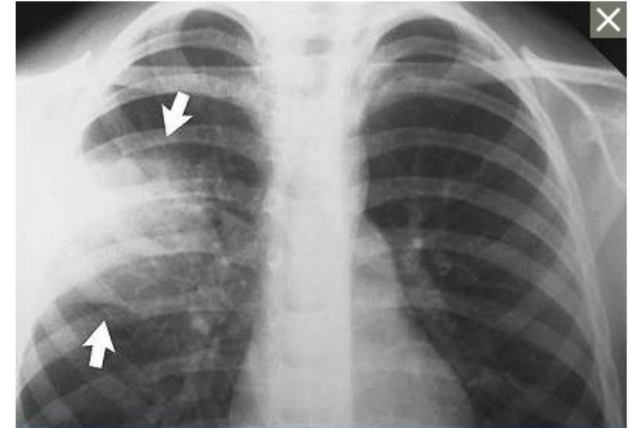
Chest X-ray showing pneumonia

This chest X-ray shows an area of lung inflammation indicating the presence of pneumonia.

How The Computer Program Works

1. We will feed images on lungs infected with pneumonia and normal lung images.
2. The program will look at these images in detail.
3. Learning will take place from looking at thousands of images.
4. The images will be classified
5. Our program will return a percentage of how many pictures it was able to classify.

The Result

- We will have a program that can read images.
- This program will be able to classify the images for healthcare workers.
- This will help speed up patient diagnosis
- The sooner we can treat a patient, the better the prognosis.

Baseline Model

Train set:
================
PNEUMONIA=3883
NORMAL=1342
Test set:
================
PNEUMONIA=390
NORMAL=234
Validation set:
================
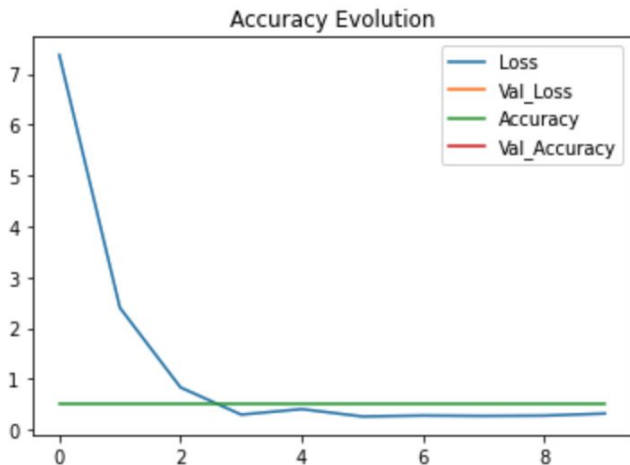PNEUMONIA=8
NORMAL=8

⬅ **Data Set**
The more images, the better the results


```
Model: "sequential_1"

Layer (type)                 Output Shape              Param #
=================================================================
dense_2 (Dense)              (None, 20)                1350020

dense_3 (Dense)              (None, 7)                 147

dense_4 (Dense)              (None, 5)                 40

dense_5 (Dense)              (None, 1)                 6
=================================================================
Total params: 1,350,213
Trainable params: 1,350,213
Non-trainable params: 0
```

Using various models to classify our image, the goal was to have our program read the images and classify them as 'Pneumonia' or 'Normal'.

Using Convolutional Neural Network Models

Various Optimizers Were Used to Make Our Model Recognize Images Better

All Had an Accuracy of:
0.50

Baseline Model:
Loss: 0.26
Accuracy: 0.50

RMSprop	**Loss: 0.26**
Adam_01	**0.26**
SGD	**0.26**
AdaDelta	**0.26**
AdaGrad	**0.26**

Conclusion

We are able to design a Neural Network that can distinguish images. This can be a big help to healthcare providers including radiologists.
Although my results were not able to create an accuracy of over 50%; it is possible to construct a model with over 90% accuracy.

Laryngoscope

Trachea

Inflated cuff

Esophagus
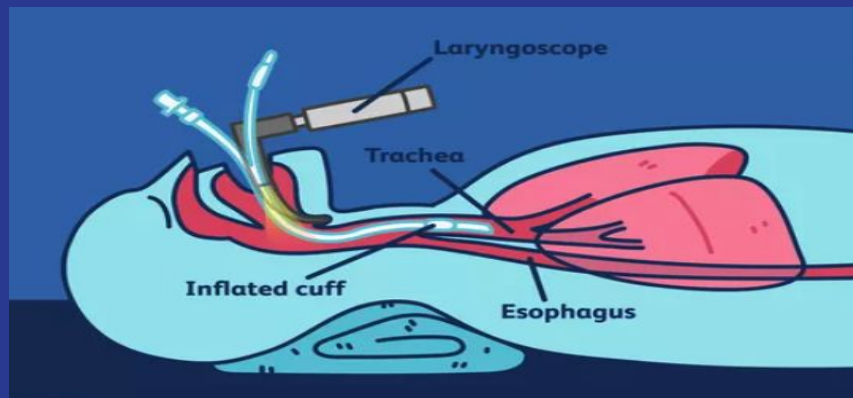
Future Work

- Develop a classifier that will distinguish between the different types of pneumonia.
- Develop a translator to label the scans.
- Create a neural network that can classify other types of images, including MRIs.

Thank You!

Appreciate the help of my instructors and the FlatIron cohort