Image Recognition for Pneumonia

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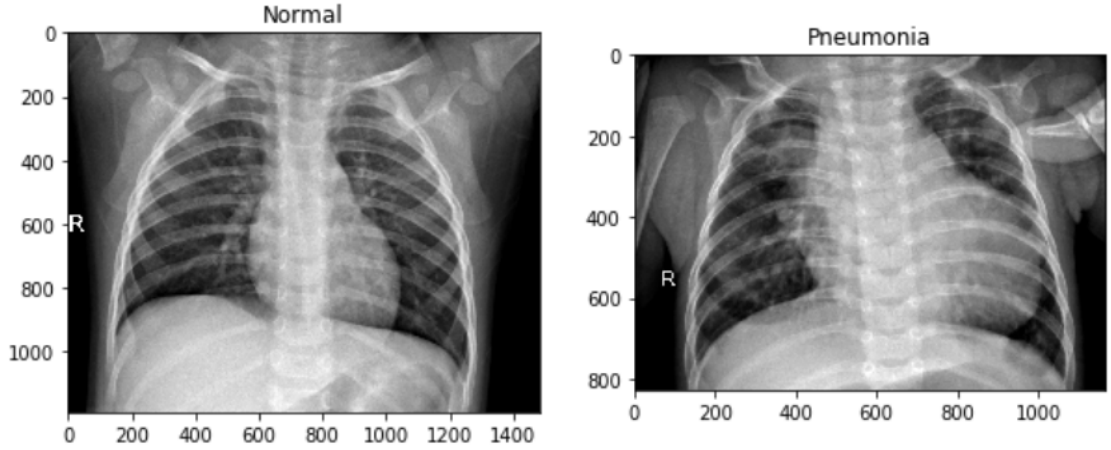
March 2020

1 The Question and Motivation

The risk of pneumonia has been immense for many, especially in developing nations where billions people face energy poverty and rely on polluting forms of energy. Estimated by the WHO, there are over 4 million premature deaths occurring annually from household air pollution-related diseases including pneumonia.

With the fast developing AI tools in neural networks (CNN) in image recognition, we could elaborate neural networks to help the doctors to speed up the pre-screening process for Pneumonia. Especially in developing countries, this technique may cause huge change in healthcare. For example, in Africa's 57 nations, there exists a gap of 2.3 million doctors and nurses.[2] This technique can effectively save time and money for those countries which are experiencing poverty.

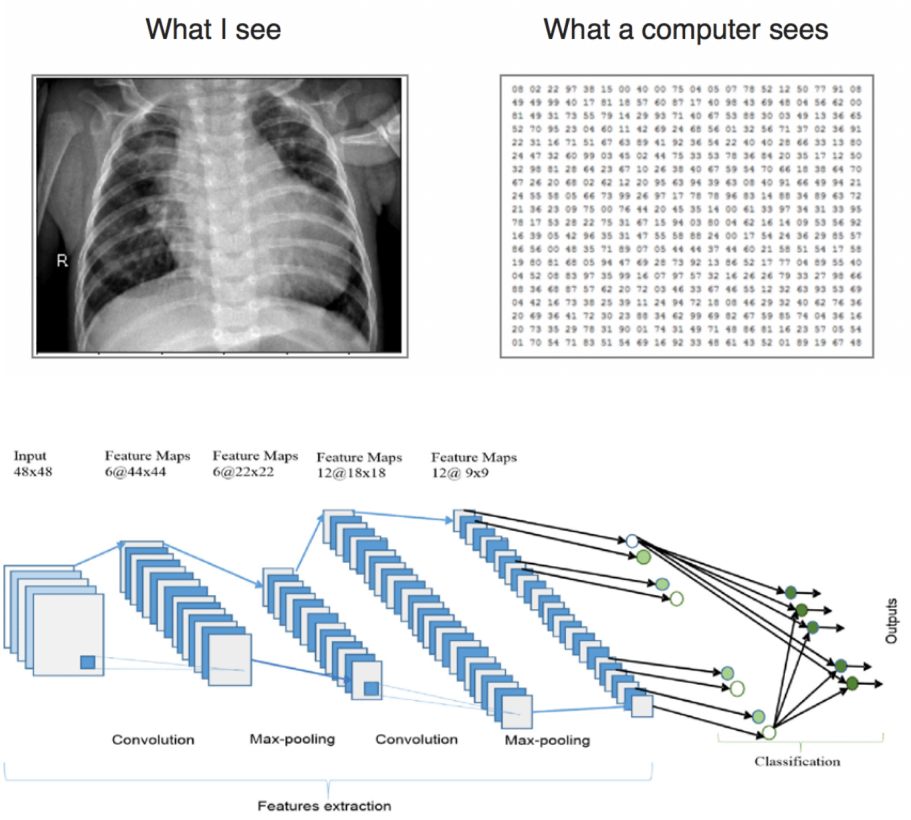
2 Data set



The data is split into train, validation and test data containing X-rays of normal lungs and lungs with Pneumonia symptoms. In the training data-set, there are around 3900 samples labeled with Pneumonia and 1400 samples labeled as normal. We will elaborate Pytorch for the data processing and transfer them from pictures into 2D tensors for future analysis.

3 Proposed Algorithm

Nowadays, the development of convolutional neural network has allowed for significant gains in the ability to classify images[1]. Combining our needs and the properties of CNN, we decided to choose it as our main algorithm.



Then we can fit our model to the dataset and compute accuracy.

4 Proposed Methods of Optimization

For this problem, we are dealing with image processing: processing them from pictures to tensors. Also we are using CNN as our major algorithm and when the networks are really deep, the training time can take a really long time. In order to speed up and maximize our algorithm, we plan to include but not limited to the following methods of optimization:

1. Line_Profilier:

   We use the line_profilier to estimate the consuming-time for different parts of the code and optimize based on it.

2. Cuda and Numba:

   Given we are using GPU for most of our analysis, we will elaborate Numba to speed up our algorithm.

3. Cython:

   For some of the functions used in the program, we will change it into Cython format.

4. Itertools:

   We would take advantage of itertools to speed up the algorithm.

References

[1] Krizhevsky, A., Sutskever, I., and Hinton, G.E. (2017). ImageNet classification with deep convolutional neural networks. Commun. ACM 60, 84–90.

[2] Stephen, O., Sain ,M.,Maduh,U.J., and Jeong, D. An Efficient Deep Learning Approach to Pneumonia Classification in Healthcare. Journal of Healthcare Engineering, Volume 2019. ID 418094