Screening Abnormalities in Chest X-Ray Images using Convolutional Neural Networks

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Abstract

In developing countries there exists an acute shortage of radiologists. The excessive workload sometimes may lead to faulty diagnosis and false negative results. This project is a deep learning model which can look at an image of an x-ray and can screen the patient for pathophysiological conditions. The way we have currently approached the problem is by using a CNN in which will give us either an 'all clear' or 'send for further consultation' for 13 documented chest conditions. The metric used for evaluating the models was F1 score.
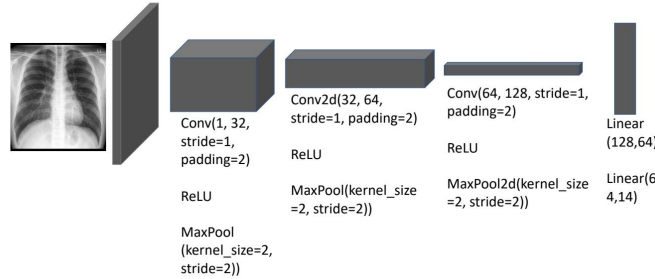
Dataset

CheXpert is a large public dataset for chest radiograph interpretation, consisting of 224,316 chest radiographs of 65,240 patients. It consists of frontal and lateral Chest X-ray images labelled with 13 documented conditions
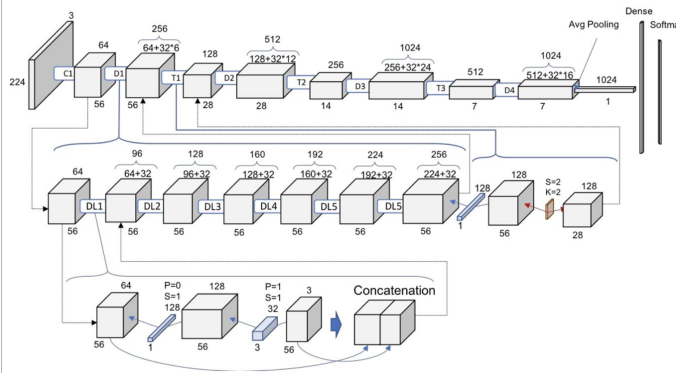
Data Preprocessing

- 'Uncertain' labels were converted to 'Positive' labels. $-1 \rightarrow 1$
- 'Unmentioned' labels were converted to 'Negative' labels. $N/A \rightarrow 0$

Model Architecture

CustomNet

Conv(1, 32, stride=1, padding=2)

ReLU

MaxPool (kernel_size=2, stride=2))

Conv2d(32, 64, stride=1, padding=2)

ReLU

MaxPool(kernel_size =2, stride=2))

Conv(64, 128, stride=1, padding=2)

ReLU

MaxPool2d(kernel_size =2, stride=2))

Linear (128,64)

Linear(64,14)

DenseNet121

Results

The metric chosen to evaluate the models was F1 score

Model	Train	Test
CustomNet	0.3541	0.3745
Densenet121	0.2679	0.2521
ResNet	0.4836	0.4690

Future

- Error Analysis: Analyze which examples are being misclassified by the model and how to improve the accuracy of the model.
- Train on frontal images and test on mixed test set.

References

Rajpurkar, P., Irvin, J., Zhu, K., Yang, B., Mehta, H., Duan, T., Ding, D., Bagul, A., Langlotz, C., Shpanskaya, K. and Lungren, M.P., CheXNet: Radiologist-Level Pneumonia Detection on Chest X-Rays with Deep Learning.[Online] December 25, 2017.