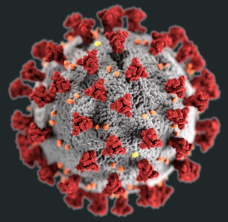

Detect COVID-19 using Chest X-rays

By (not)Shallow Learning Team
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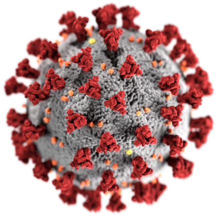
Introduction



Covid-19 also known as a novel coronavirus is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

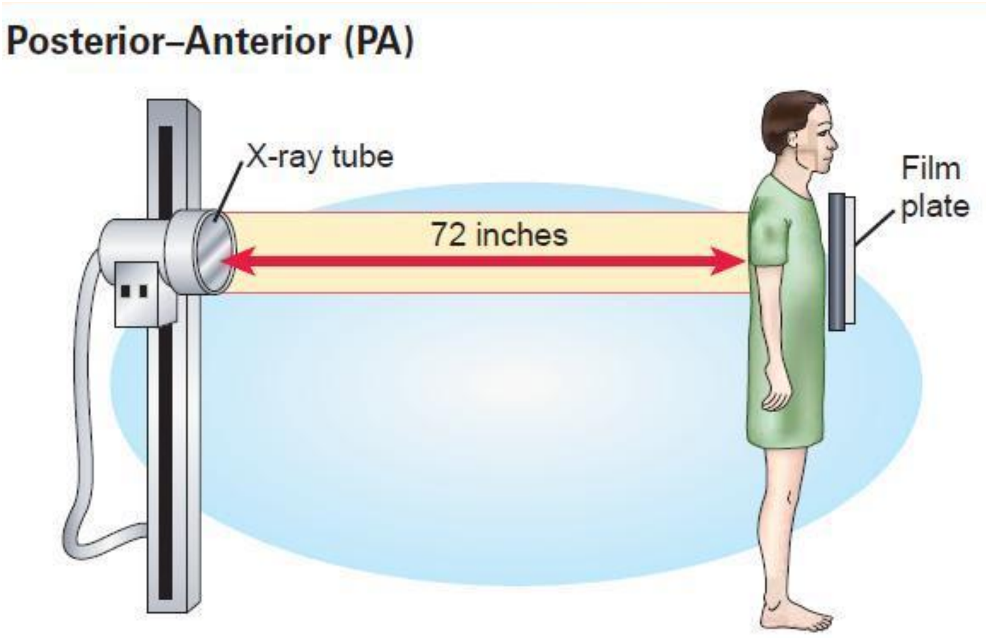
Currently we are testing covid-19 using nasal swab test. Doctors also examine Chest X-rays of a severed patients.

Dataset

Currently there is very less data. We gathered data from five different sources and combined them.

We have posteroanterior (**PA**) view of Chest X-rays.

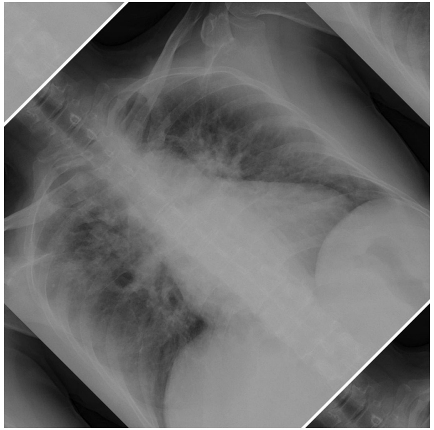
We were able to collect:
470 Covid-19 Chest X-rays,
8851 Normal Chest X-rays,
6050 Pneumonia Chest X-rays,
Total: **15,371** Chest X-rays

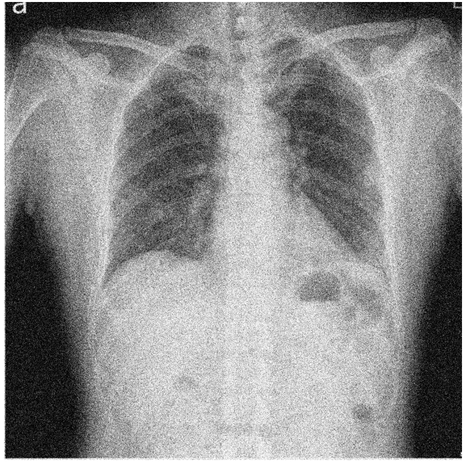


Data Augmentation and Train/Test split

Since there is little data, we augmented existing COVID-19 images to create more “fake” data

- Applied rotation (45 degrees),
- shift (by 25x25 pixels),
- horizontal and vertical flip,
- added Gaussian noise and blur





Train test split:

- Data was split into 80:20 train test split before data augmentation.

Related Work:

COVID-Net: A Tailored Deep Convolutional Neural Network Design for Detection of COVID-19 Cases from Chest X-Ray Images

Linda Wang[1,2,3*], Zhong Qiu Lin[1,2,3], and Alexander Wong[1,2,3]

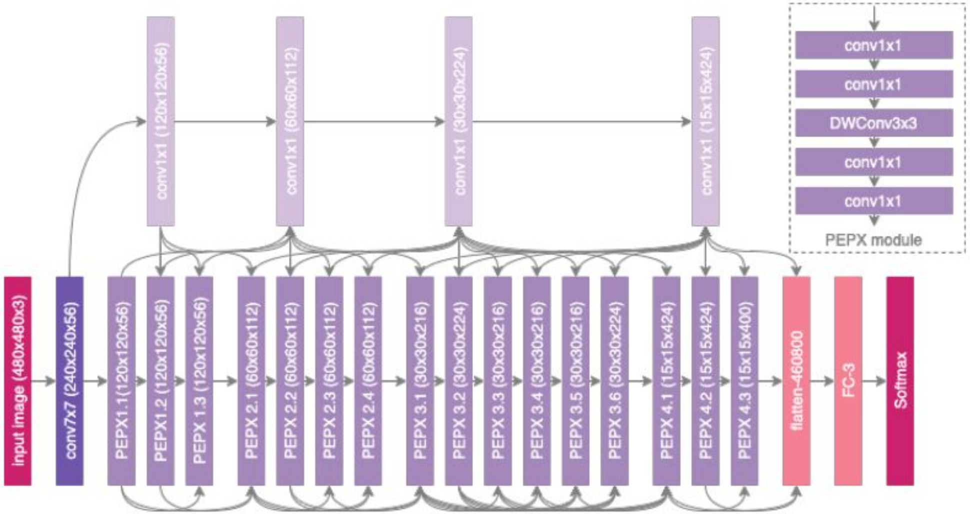


Figure 5. COVID-Net Architecture. High architectural diversity and selective long-range connectivity can be observed as it is tailored for COVID-19 case detection from CXR images. The heavy use of a projection-expansion-projection design pattern in the COVID-Net architecture can also be observed, which provides enhanced representational capacity while maintaining computational efficiency.

93.3% Accuracy

Our CovNet

Xavier Initialization +
Adam Optimizer +
Cross Entropy Loss Function

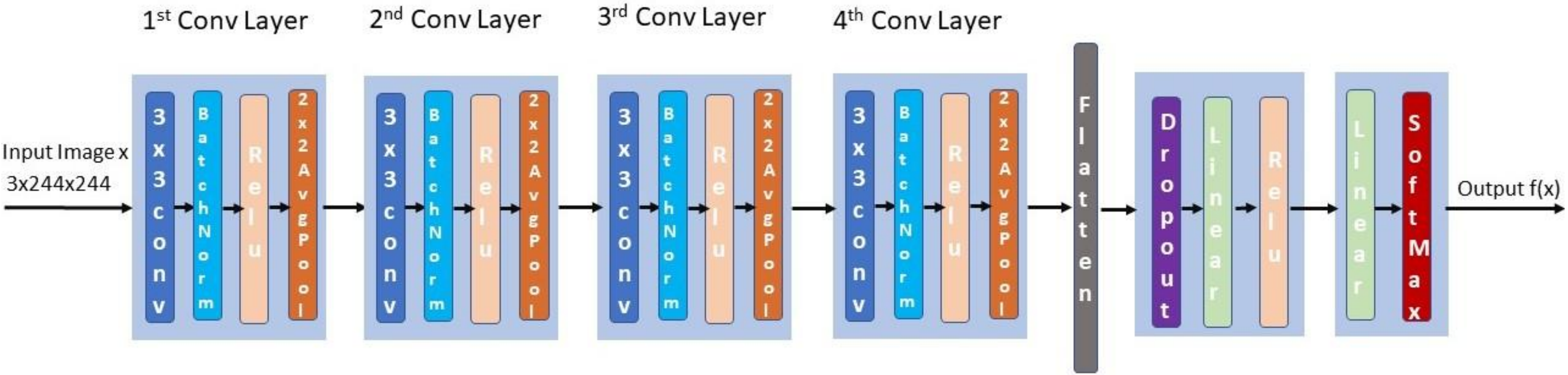
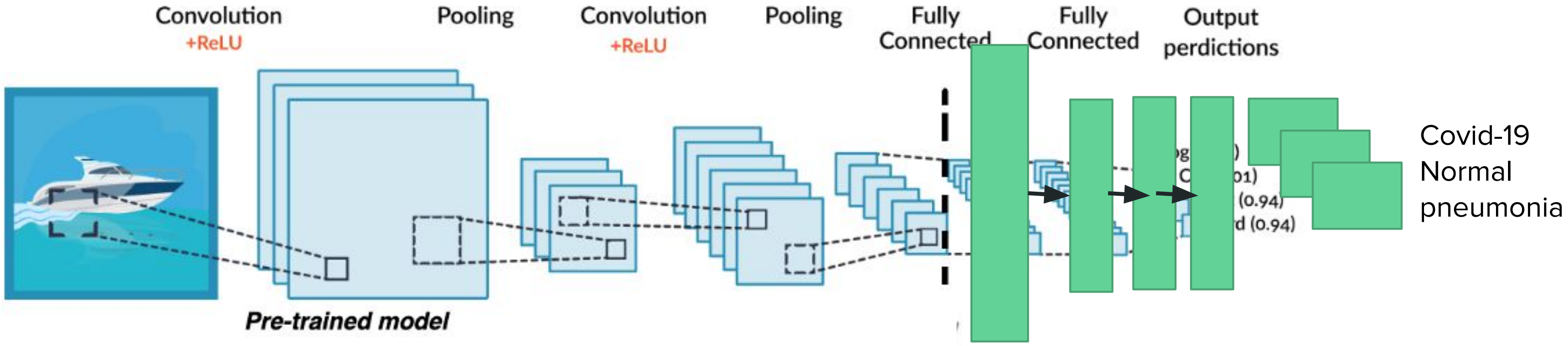


Fig: Our ConvNet

Transfer Learning: Overview

- Use pre trained model to increases performance and speed up the learning process.
- We are using off-the-shelf pre-trained models as Feature Extractor.



- We are using AlexNet, VGG-19bn models which were pre-trained on ImageNet dataset with millions of images and thousands of classes.

Img src: https://mc.ai/transfer-learning-with-deep-learning-machine-learning-techniques/

Result:

	COVID-19	Normal	Pneumonia	Overall
Our ConvNet	74.16%	90.78%	84.46%	87.00%
AlexNet	76.04%	92.00%	83.82%	88.00%
VGG-19-bn	43.52%	92.83%	80.73%	84.00%
ResNet-50	20.15%	86.45%	78.28%	74.00%

Fig: accuracy of all networks per class and overall.

Future Work - Where do we go from here

1. Collect more data
2. Custom Loss function for imbalance data i.e. Focal Loss
3. Incorporate Advance DL techniques such as Meta Learning

References

Dataset:

- https://github.com/ieee8023/covid-chestxray-dataset
- https://www.kaggle.com/tawsifurrahman/covid19-radiography-database
- https://github.com/agchung/Actualmed-COVID-chestxray-dataset
- https://github.com/agchung/Figure1-COVID-chestxray-dataset
- https://www.kaggle.com/c/rsna-pneumonia-detection-challenge

- https://www.cdc.gov/coronavirus/2019-ncov/index.html
- https://www.kob.com/albuquerque-news/covid-19-doctor-explains-how-the-nasal-swab-procedure-works-/5678373/
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