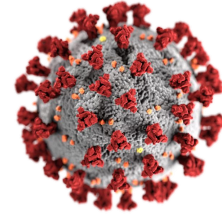


# **Detect COVID-19 using Chest X-rays**

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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 severely ill 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:

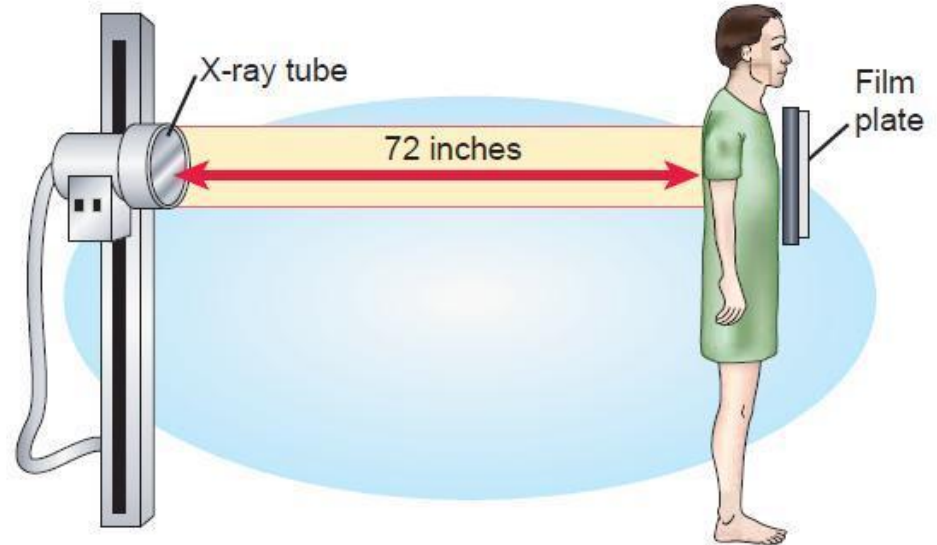
**470** Covid-19 Chest X-rays,

**8851** Normal Chest X-rays,

**6050** Pneumonia Chest X-rays,

Total: **15,371** Chest X-rays

Posterior–Anterior (PA)



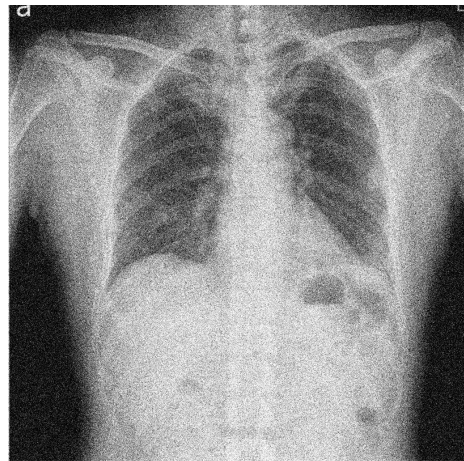
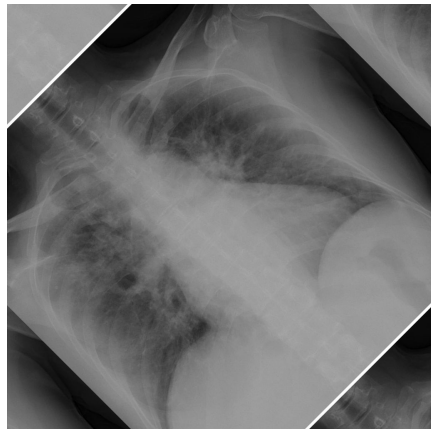
# Data Augmentation and Train/Test split

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:

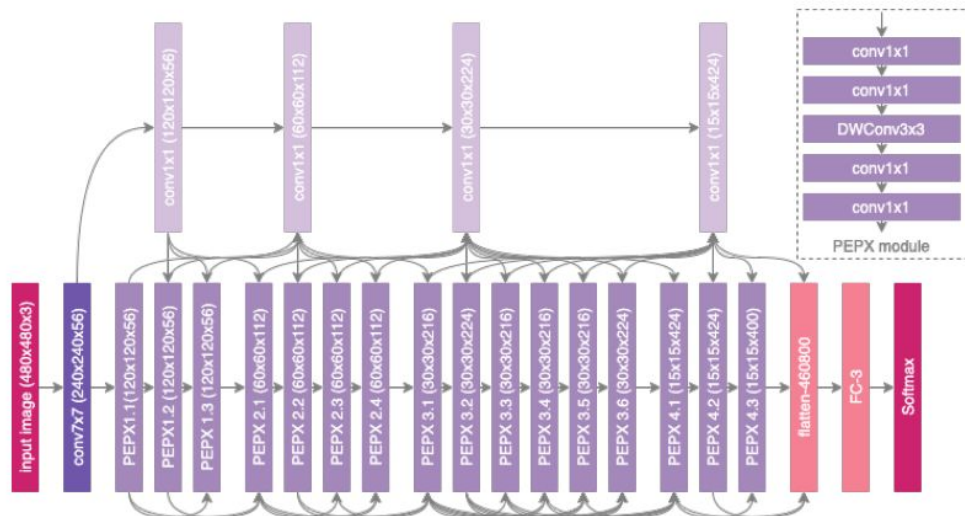
- Data was split into 80:20 train test split, with 3 classes per split - COVID-19, pneumonia, normal
- 7896 train images (**2632** for each class)
- 1974 test images (**658** for each class)



## Related Work:

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

Linda Wang<sup>1,2,3\*</sup>, Zhong Qiu Lin<sup>1,2,3</sup>, and Alexander Wong<sup>1,2,3</sup>



93.3% Accuracy

**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.

# Our Small CovNet

Xavier Initialization +  
Adam Optimizer +  
Cross Entropy Loss Function

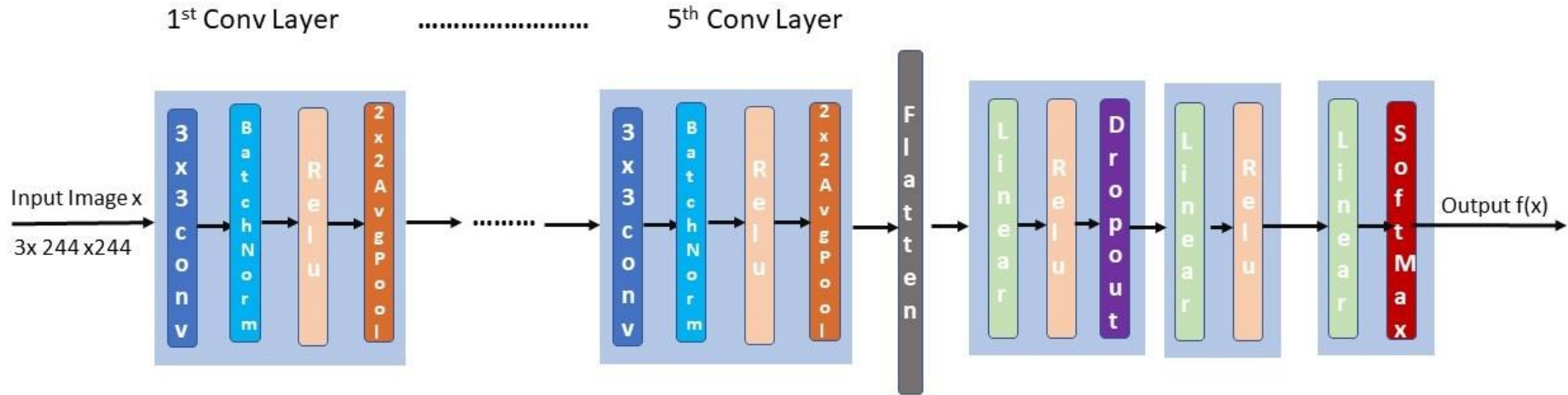
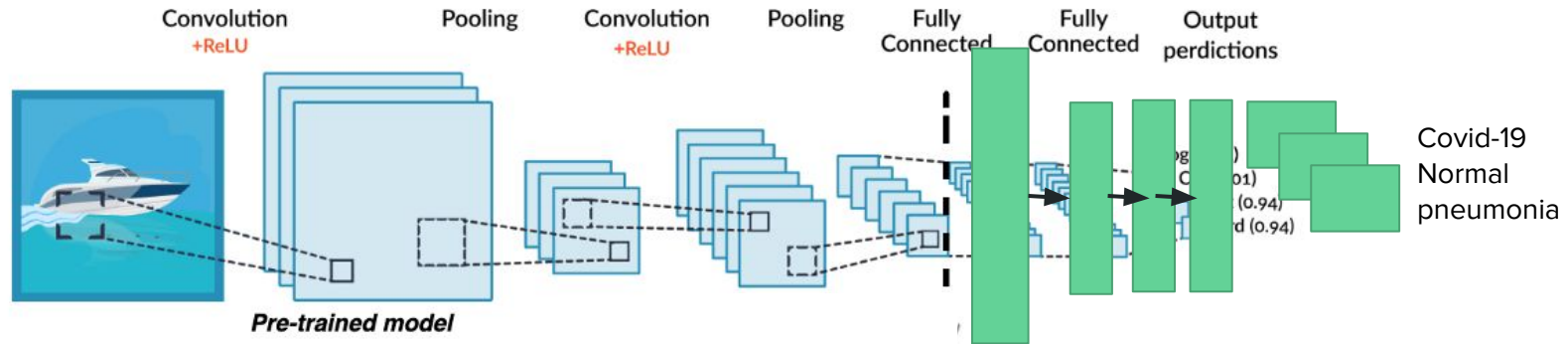


Fig: 5 layer ConvNet

# Transfer Learning: Overview

- Use pre trained model to increase 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.

## Result:

	COVID-19	Normal	Pneumonia	Overall
<b>Our ConvNet</b>	74.16%	90.78%	84.46%	87.00%
<b>AlexNet</b>	76.04%	92.00%	83.82%	88.00%
<b>VGG-19-bn</b>	43.52%	92.83%	80.73%	84.00%
<b>ResNet-50</b>	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/>
- <https://pytorch.org/docs/stable/torchvision/models.html>
- <http://image-net.org/>