

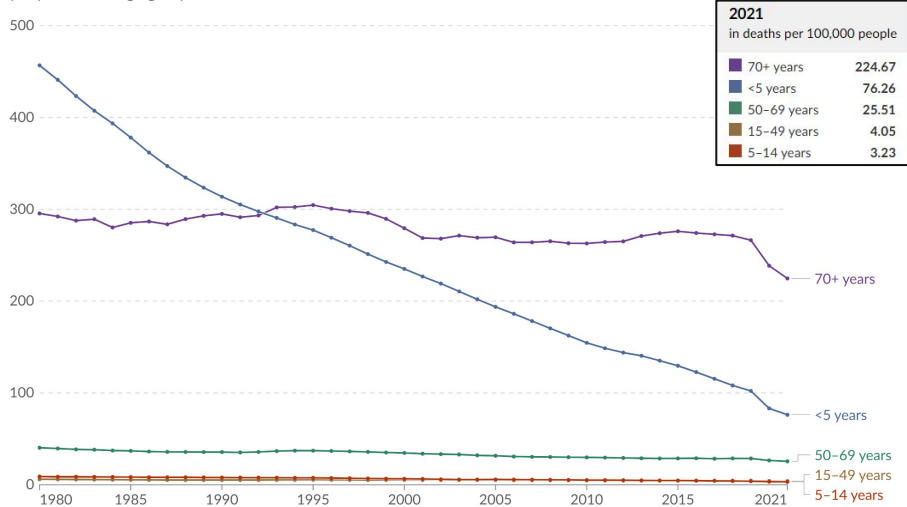
# Pneumonia Detection

1. **Overview**
2. **Data**
3. **Modeling**
4. **Next Steps**

# Dangers of Pneumonia

## Death rate from pneumonia, by age, World

The estimated annual death rate from pneumonia<sup>1</sup> and other lower respiratory tract infections per 100,000 people in each age group.

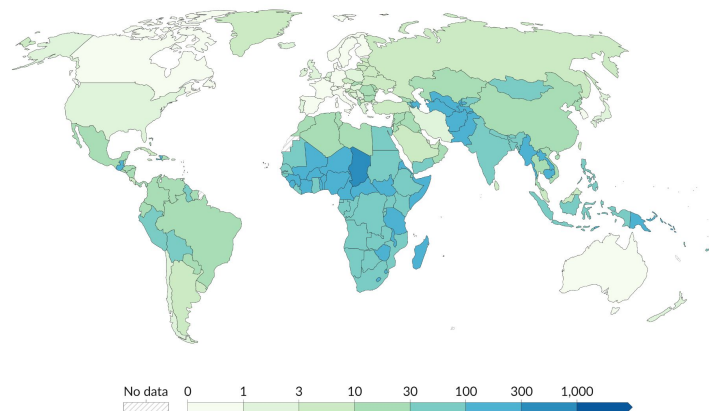


Data source: IHME, Global Burden of Disease (2024)

OurWorldinData.org/pneumonia | CC BY

## Death rate from pneumonia and other lower respiratory infections in children, 2021

The estimated annual death rate from pneumonia<sup>1</sup> and other lower respiratory infections in children under five, per 100,000.



Data source: IHME, Global Burden of Disease (2024)

OurWorldinData.org/child-mortality | CC BY

# Our Goal

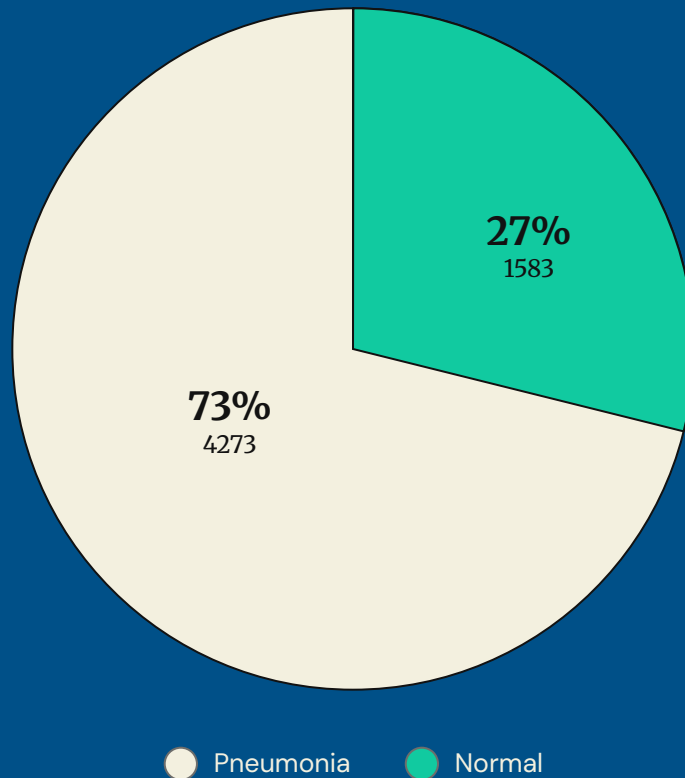
Build a model proficient in detecting pneumonia from x-ray scans. This can then be deployed for hospitals, but the main target is to help areas with high poverty rates.

A false positive is preferred over a false negative, i.e., we would prefer incorrectly diagnosing someone as having pneumonia as opposed to incorrectly diagnosing someone as not having pneumonia.



# Class Imbalance

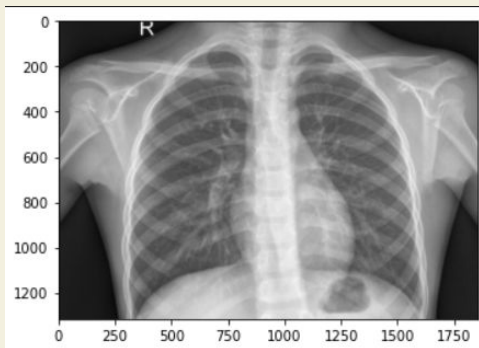
- Substantially more Pneumonia images compared to Normal images
- Could lead to bad generalization



# Data Augmentation

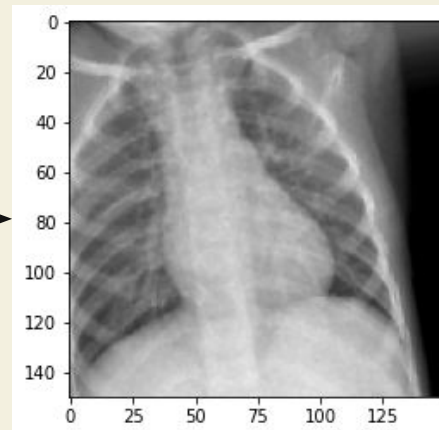
- Preprocess Images
- Create artificial data with slight augmentations every epoch
- Helps with class imbalance and prevent overfitting

Before



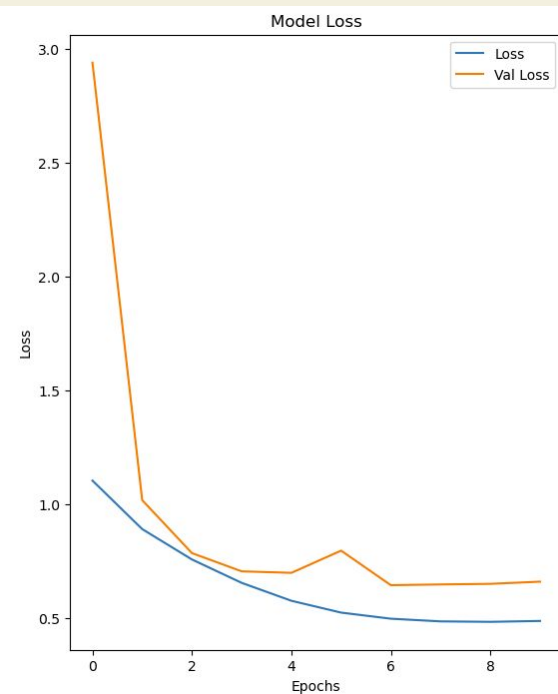
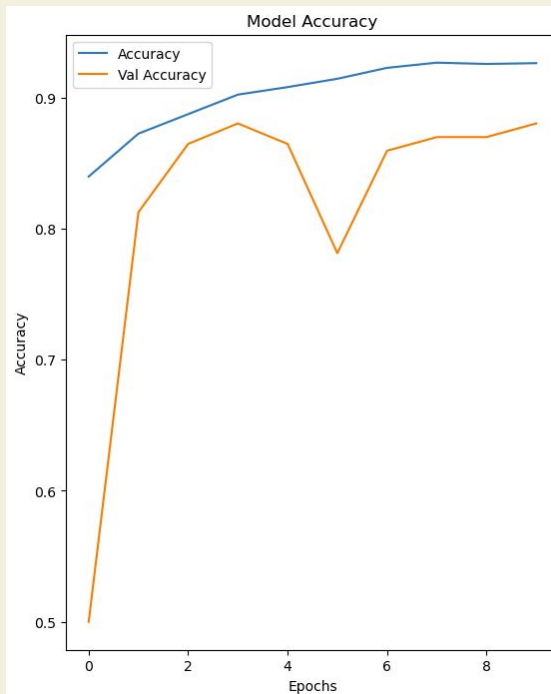
ImageDataGenerator

After



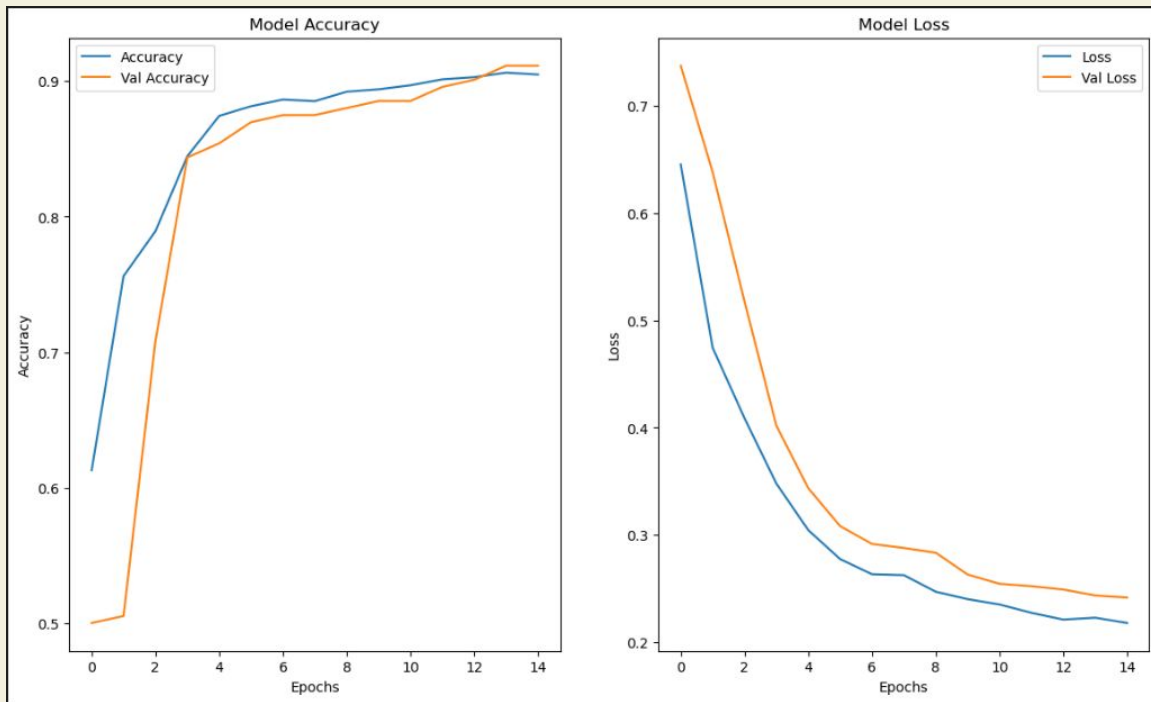
# Custom CNN

- 4 layer network
- Good train accuracy, lagging validation accuracy
- 87% Accuracy on unseen data
- 93% Recall Score



# VGG16

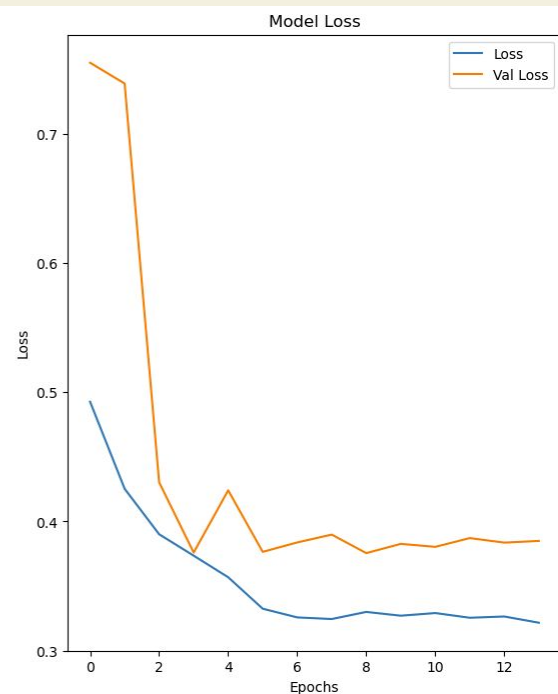
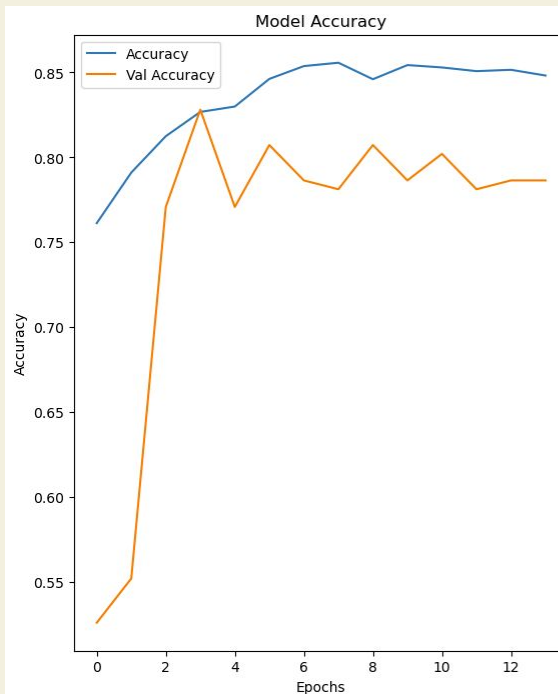
- Convolutional Neural Network architecture that is simpler in structure
- Pre trained weights used, the connected classifier removed to use our own
- 89% Accuracy on unseen data
- 94% Recall Score





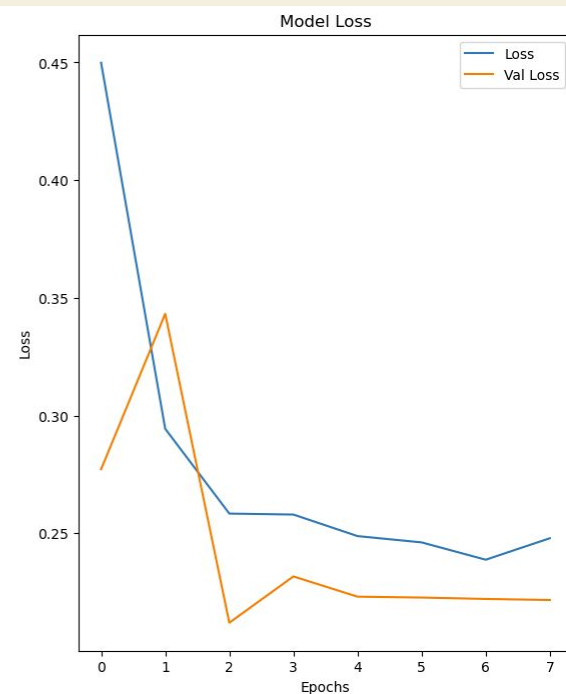
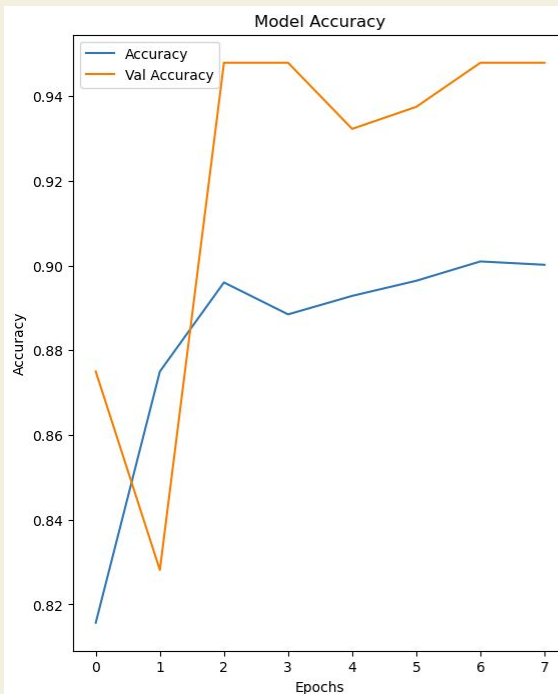
# ResNet50

- Deeper network compared to VGG16
- However, fared quite a bit worse
- Worse accuracy and worse generalization
- 79% Accuracy on unseen data
- 94% Recall Score



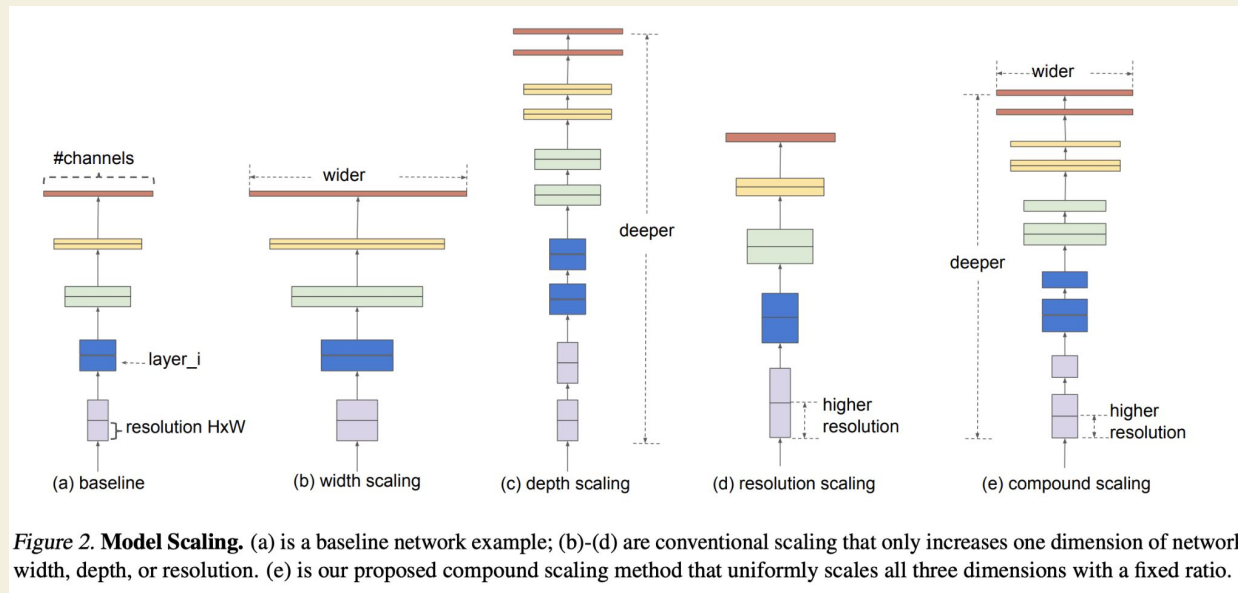
# EfficientNet

- Developed by Google researchers in 2019
- Efficient with resources
- 88% Accuracy on unseen data
- 96% Recall Score



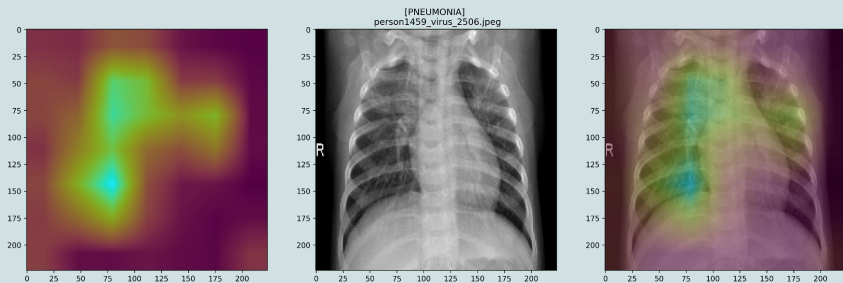
# EfficientNet

- Best performing neural network
- Uses compound scaling, which scales all three dimensions of a network(layers, channels, image size) simultaneously



# Next Steps

- Implement Grad-CAM



- Run model on much larger dataset (4x larger)

# Questions?