Pneumonia Detection

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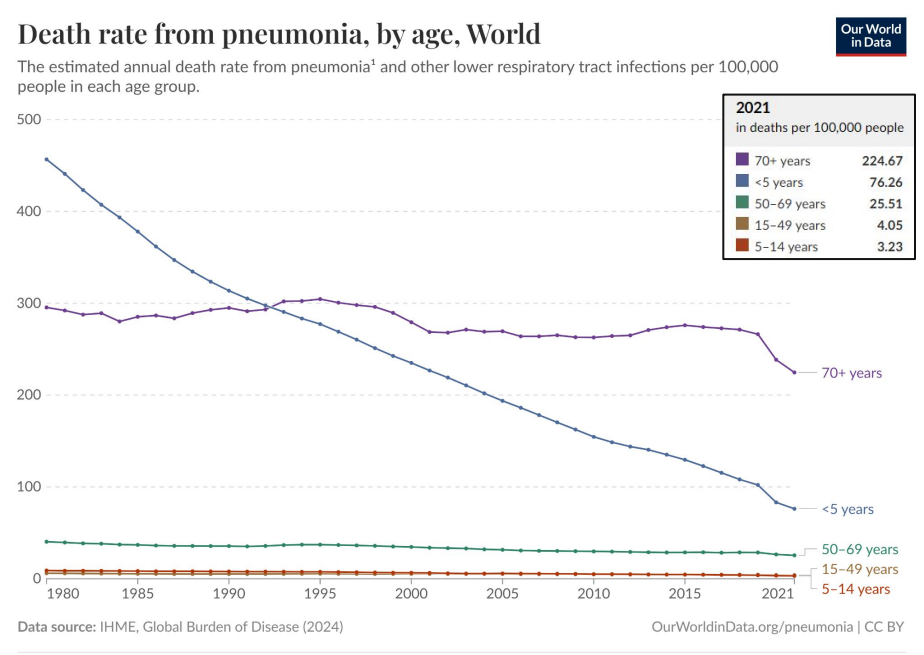
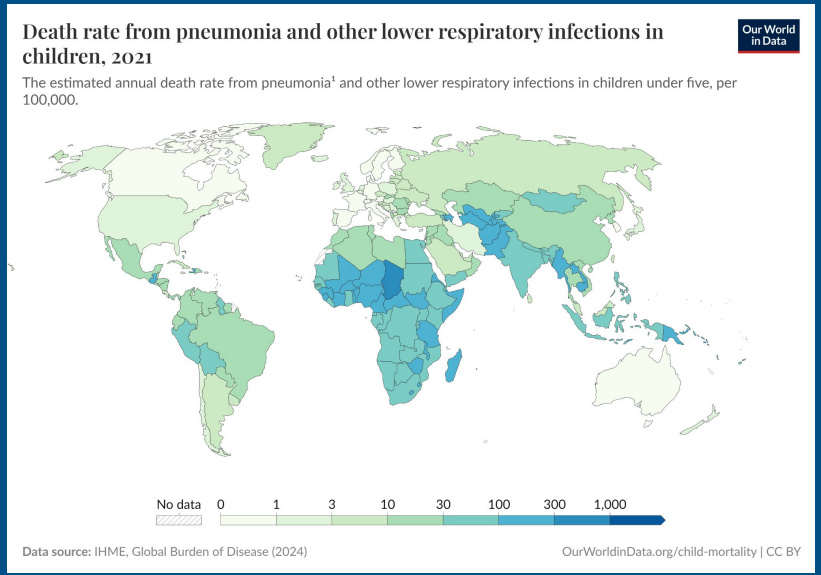
1. **Overview**
2. Data
3. Modeling
4. Next Steps

Dangers of Pneumonia





Our Goal

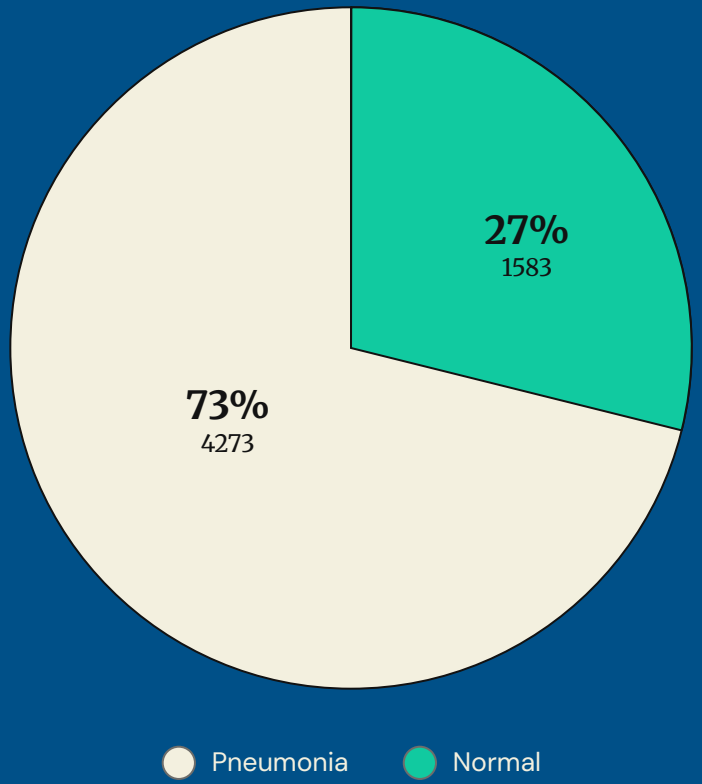
Build a model proficient in detecting pneumonia from x-ray scans. This can then be deployed for hospitals, but the main target is to help areas with high poverty rates.

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

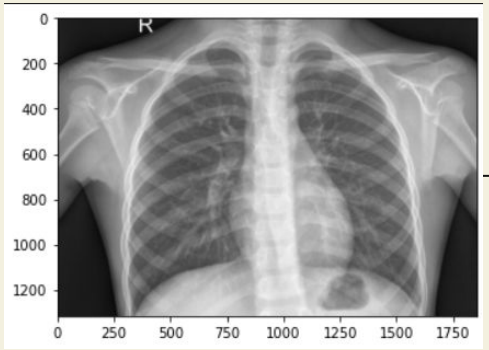
- Could lead to bad generalization



Data Augmentation

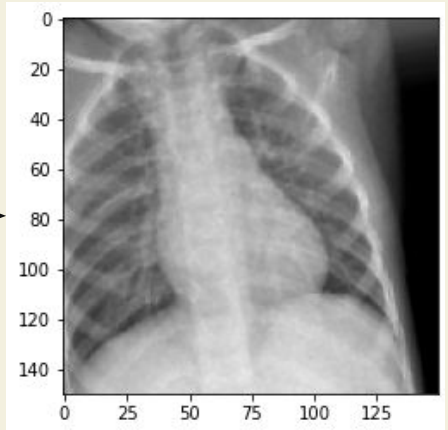
- Preprocess Images
- Create artificial data with slight augmentations every epoch
- Helps with class imbalance and prevent overfitting

Before



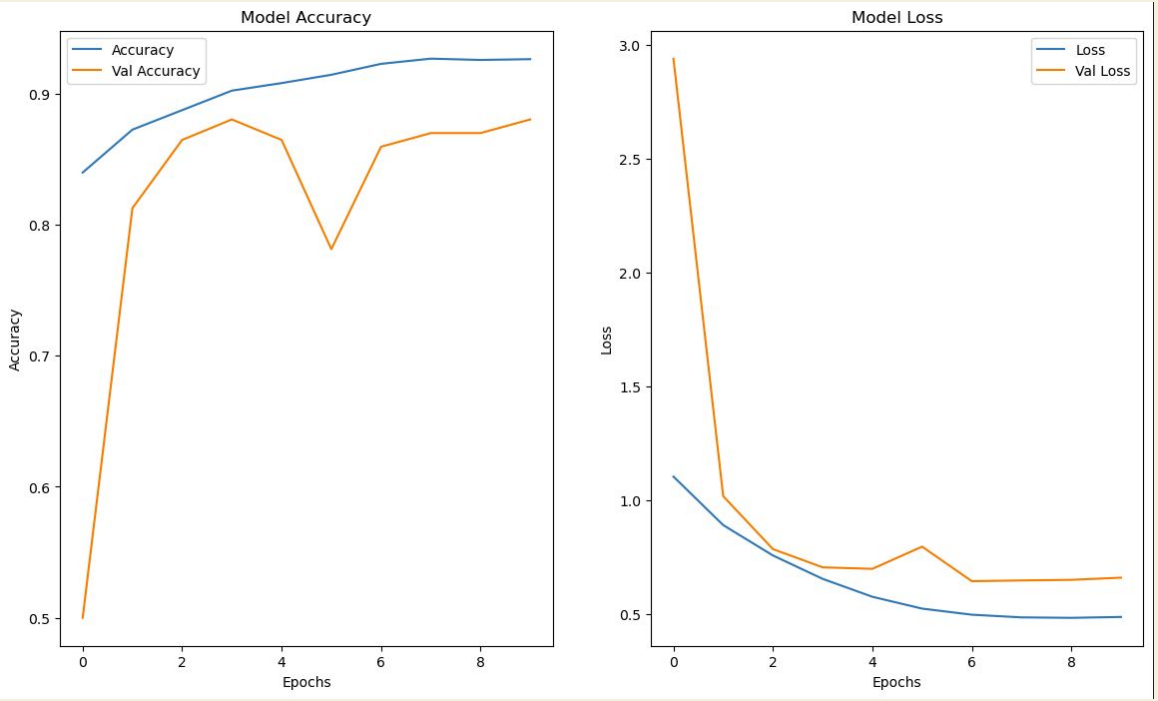
ImageDataGenerator

After



Custom CNN

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



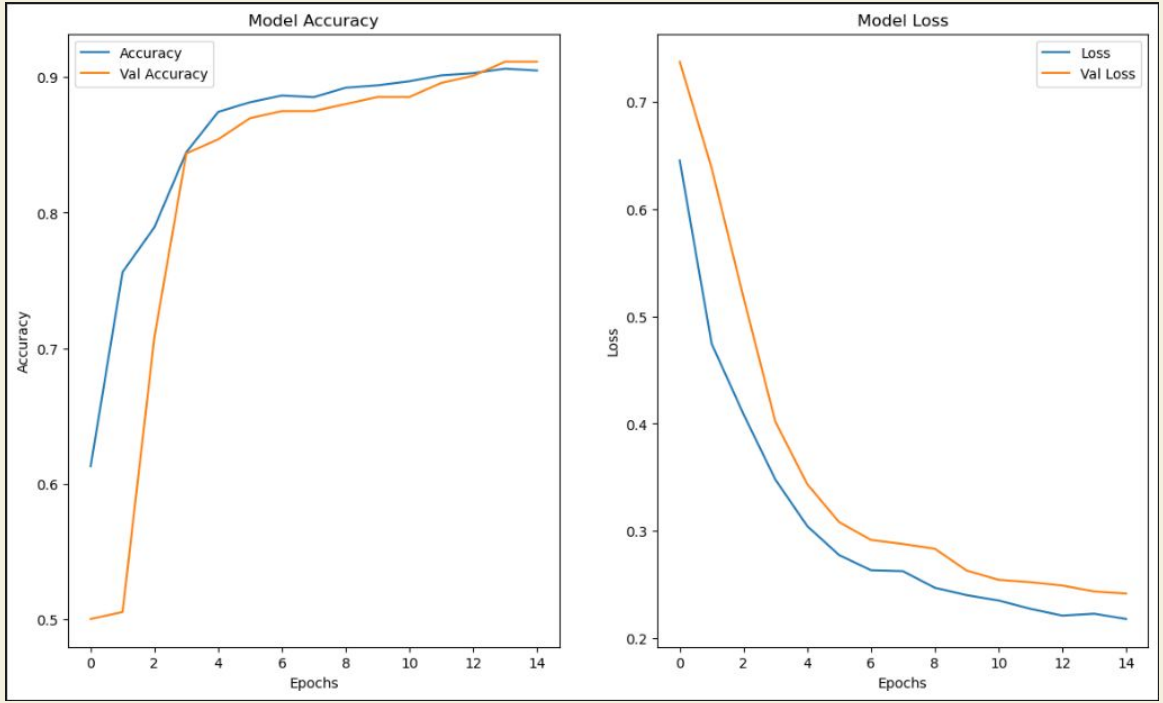
VGG16

- Convolutional Neural Network architecture that is simpler in structure

- Pre trained weights used, the connected classifier removed to use our own

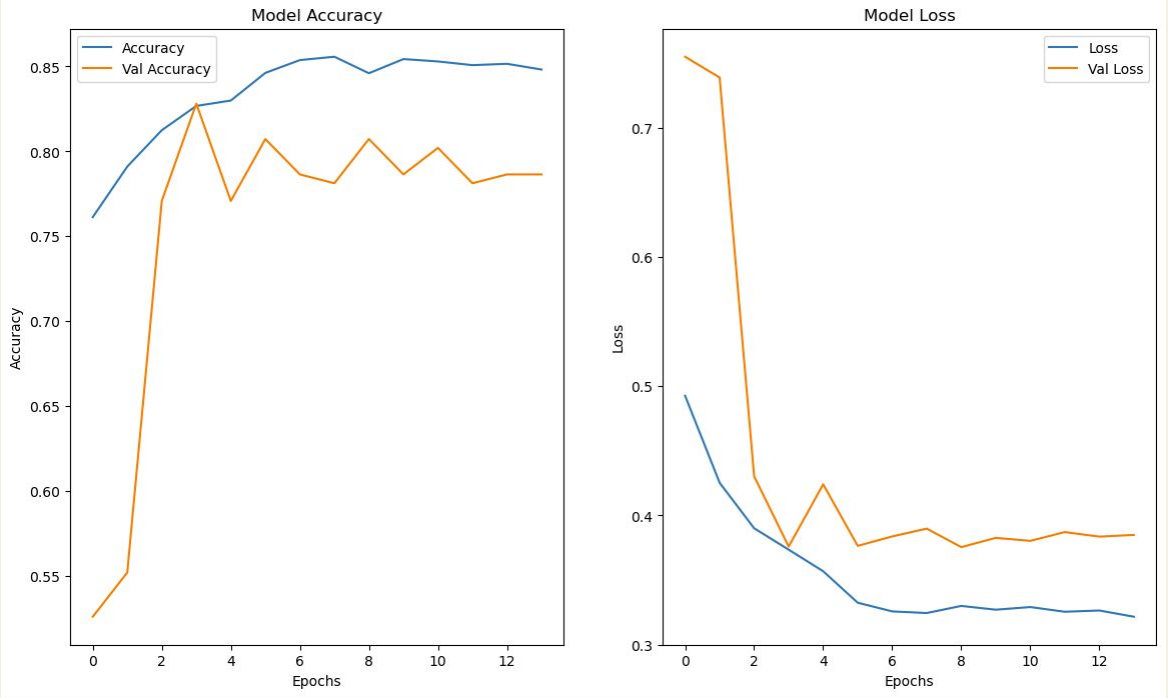
- 89% Accuracy on unseen data

- 94% Recall Score



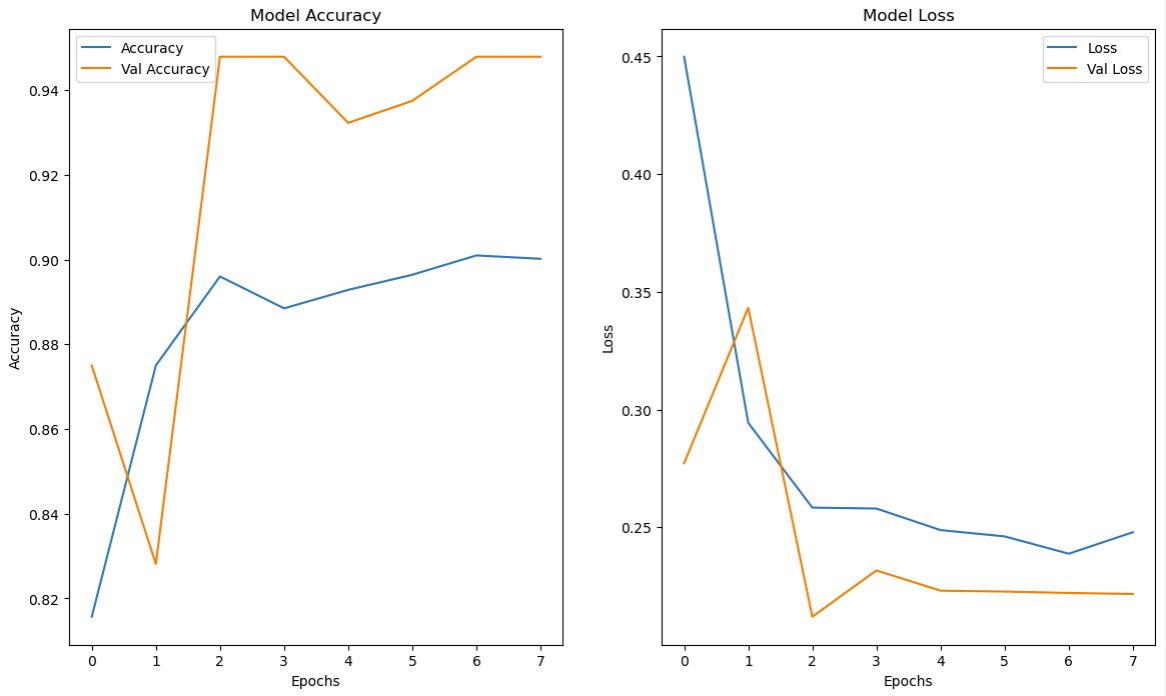
ResNet50

- 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

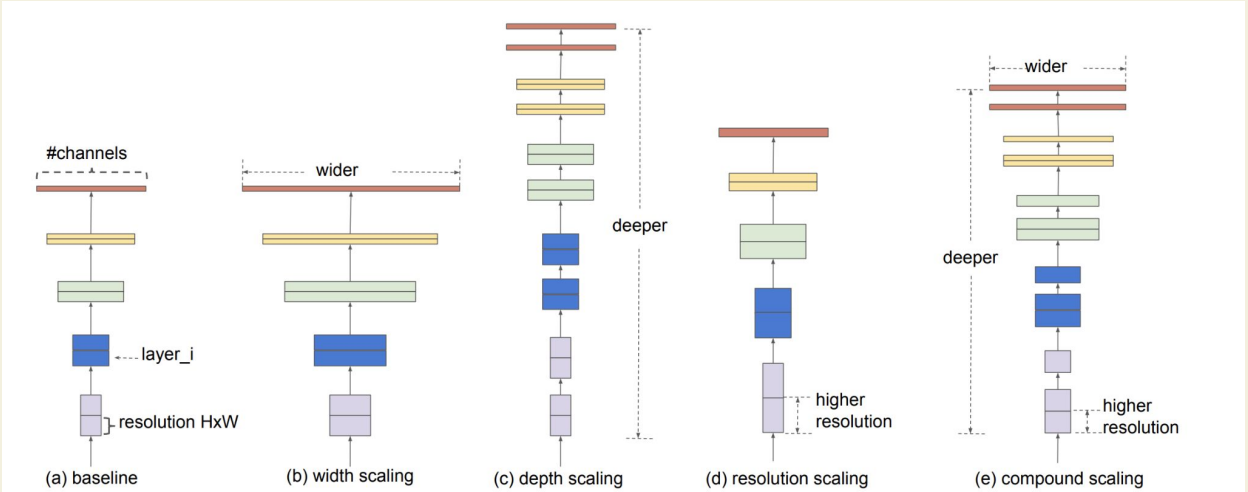
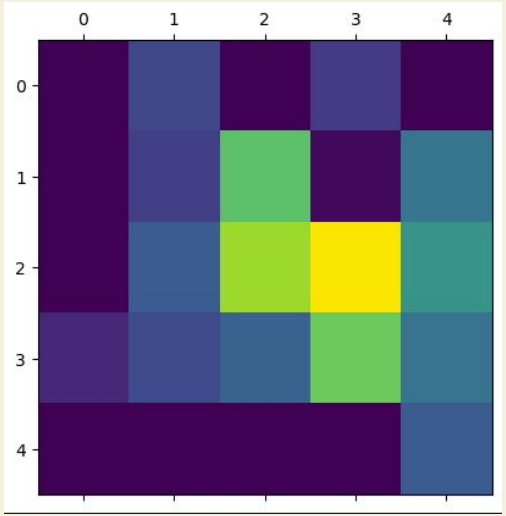


Figure 2. **Model Scaling.** (a) is a baseline network example; (b)-(d) are conventional scaling that only increases one dimension of network width, depth, or resolution. (e) is our proposed compound scaling method that uniformly scales all three dimensions with a fixed ratio.

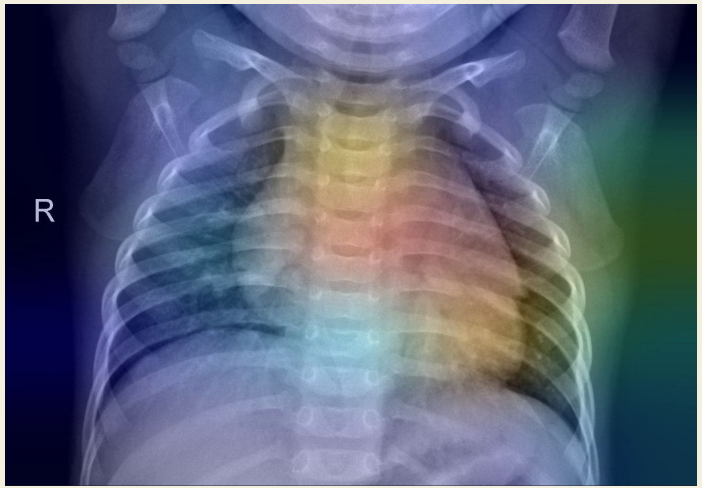
Grad-CAM

- Visualizes regions from input image that were important in leading to its final decision
- Very rudimentary implementation, but still shows it is working

Grad-CAM output

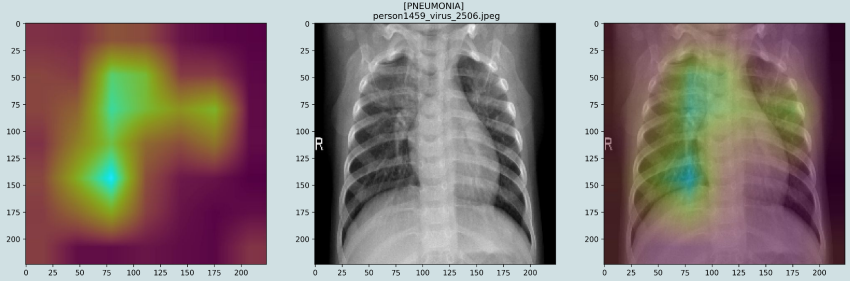


Overlayed on input image



Next Steps

- Better implementation of Grad-CAM



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

Questions?