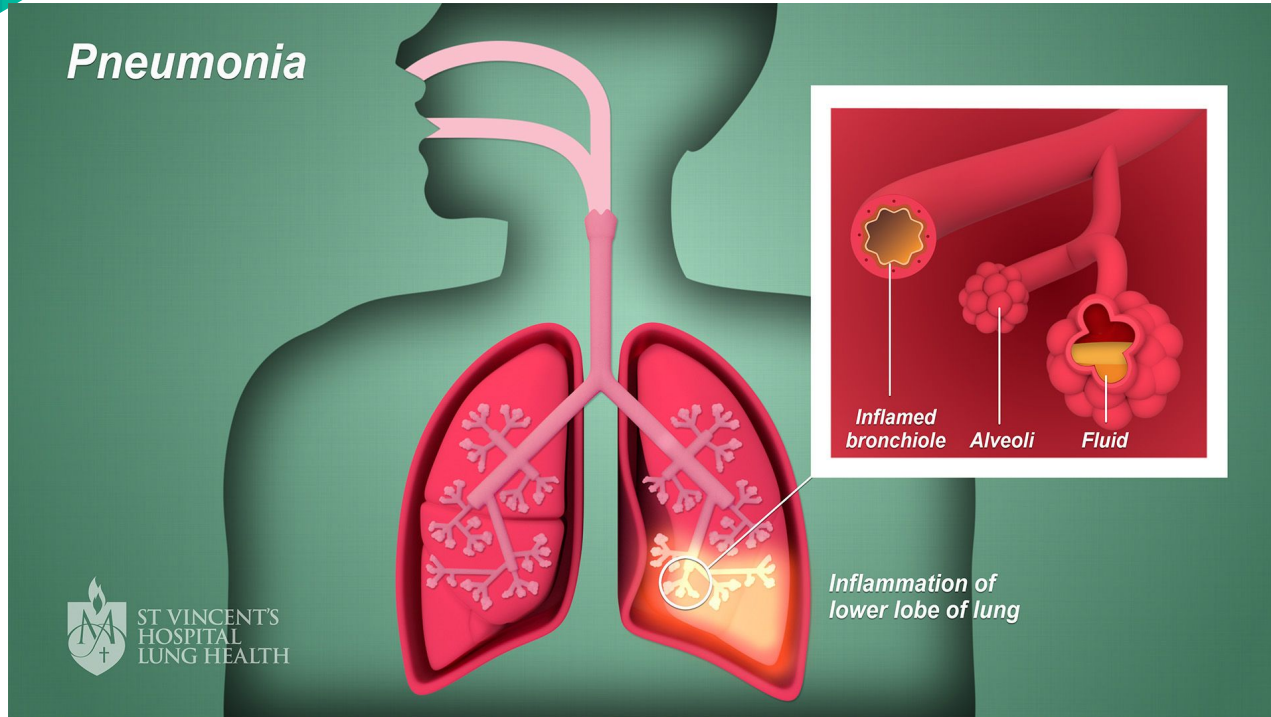# Using Computer Vision To Diagnose Pneumonia

By: Vivienne DiFrancesco
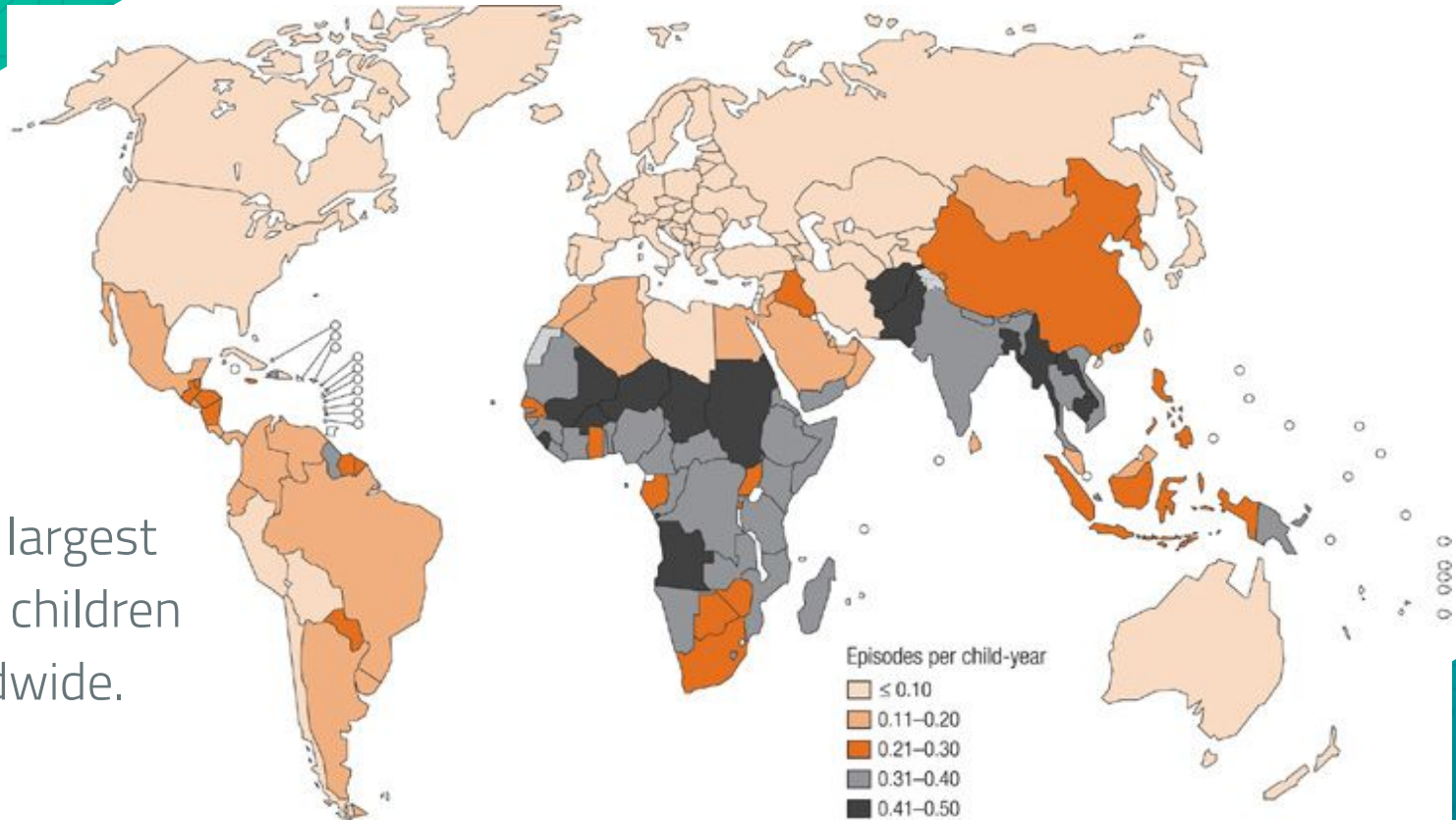
What is pneumonia?

Pneumonia affects people of all ages with 50,000 deaths from pneumonia in the US each year.

Pneumonia

Inflamed bronchiole   Alveoli   Fluid

Inflammation of lower lobe of lung

ST VINCENT'S HOSPITAL LUNG HEALTH

Source: CDC

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Childhood pneumonia

Pneumonia is the largest infectious killer of children under age 5 worldwide.

Episodes per child-year
- ≤ 0.10
- 0.11–0.20
- 0.21–0.30
- 0.31–0.40
- 0.41–0.50

About the disease

Symptoms:

- Cough
- Chest pain
- Fatigue
- Fever, chills

Treatments:

- Antibiotics
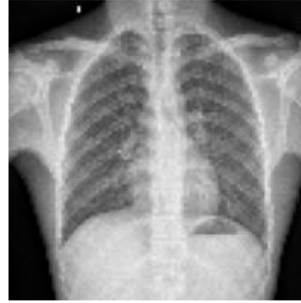- Cough medicine
- Pain relievers
- Hospital stay

Prevention:

- Vaccines
- Good hygiene
- Keep healthy habits

If we had technological tools that could help doctors diagnose patients more accurately and quickly, it would reduce costs, ease suffering, and save lives.

The Data

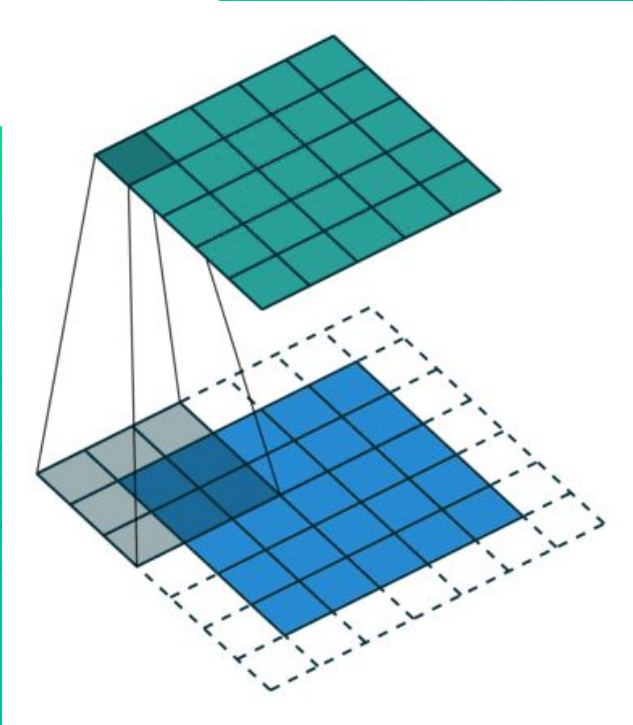Over 5,800 X-rays of children between one and five.

Normal X-Ray Images

Pneumonia X-Ray Images

Convolutional Neural Network (CNN)

- Main principle behind the term "computer vision"
- Scans across the pixels of images to take in the details of the pictures
- Computer makes many of these scans, compiles them, scans again.

Method

1. Build simple CNN model as a base
2. Test out different parameters and compare to the base model
3. Combine parameters that improve performance to come up with a best overall model
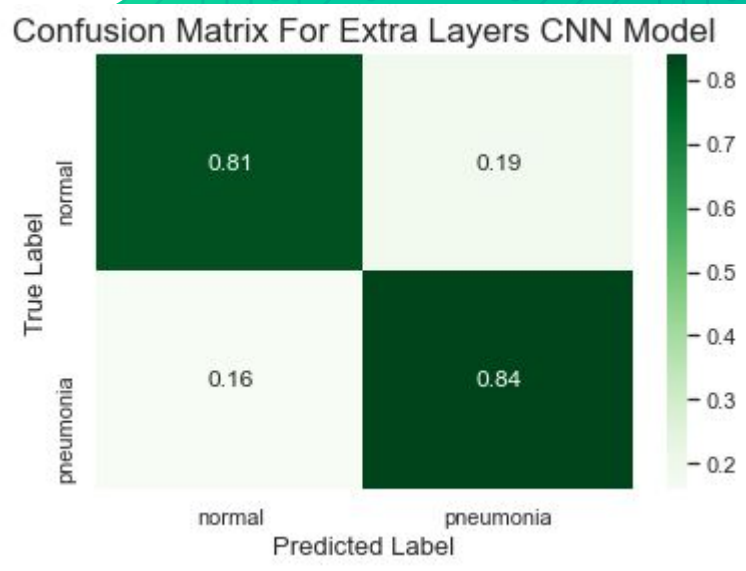
Best Model Results

- Overall accuracy of 94%
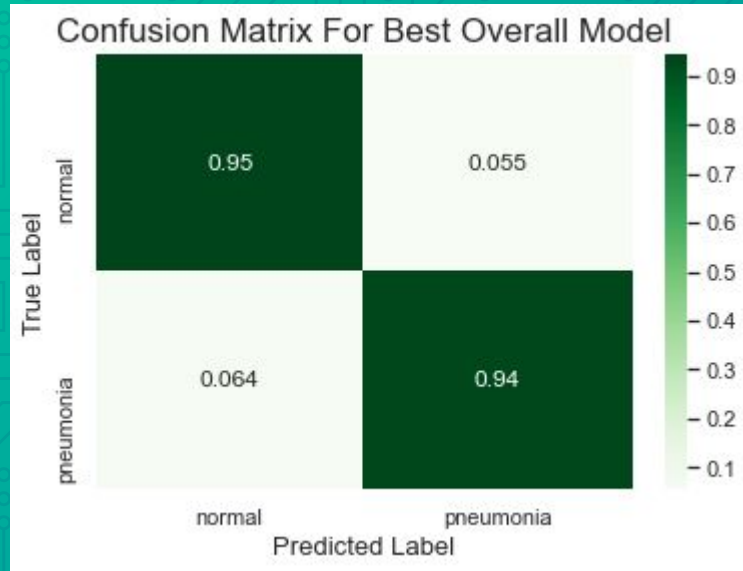- Low number of false positives and false negatives

Confusion Matrix For Best Overall Model
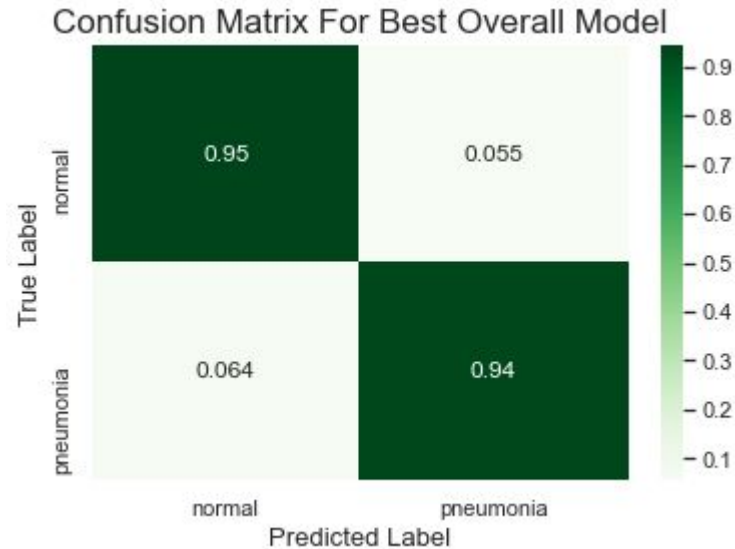
Recommendation 1:
Use a simpler model

Confusion Matrix For Extra Layers CNN Model

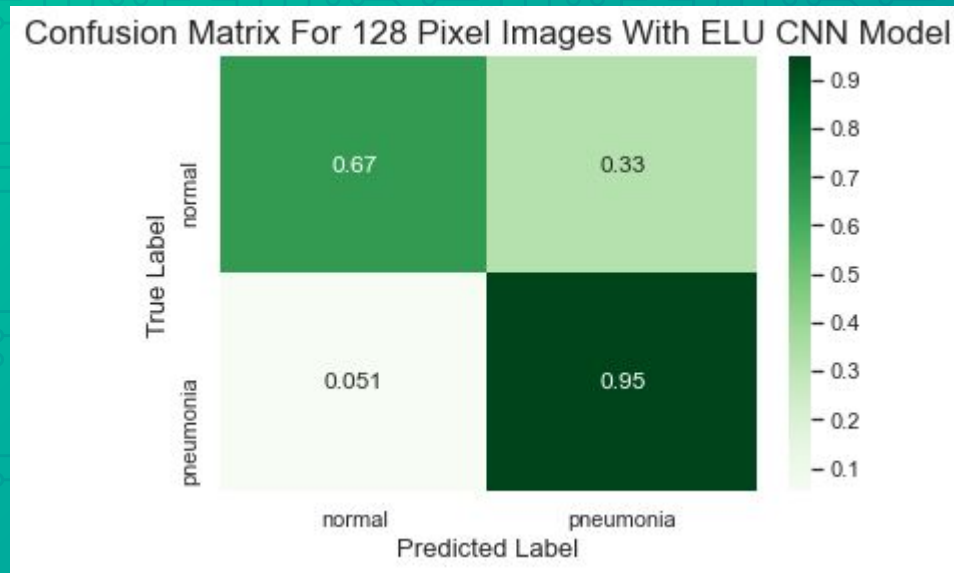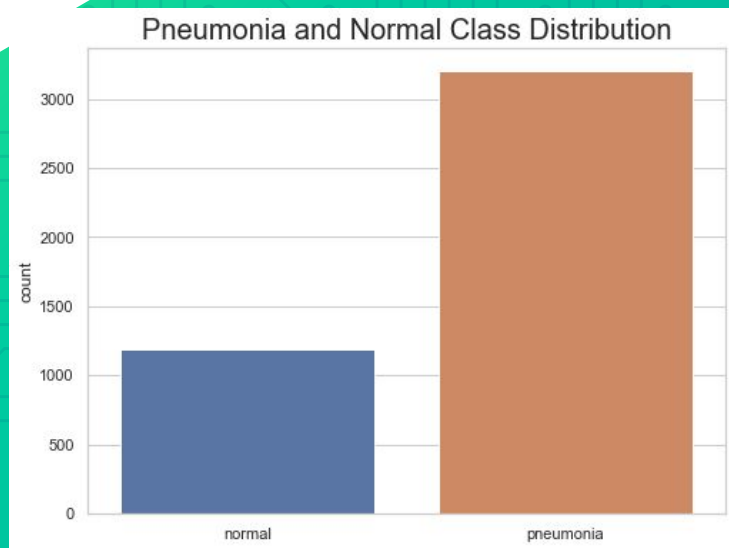Confusion Matrix For Best Overall Model

Complex

Simple

Recommendation 2:

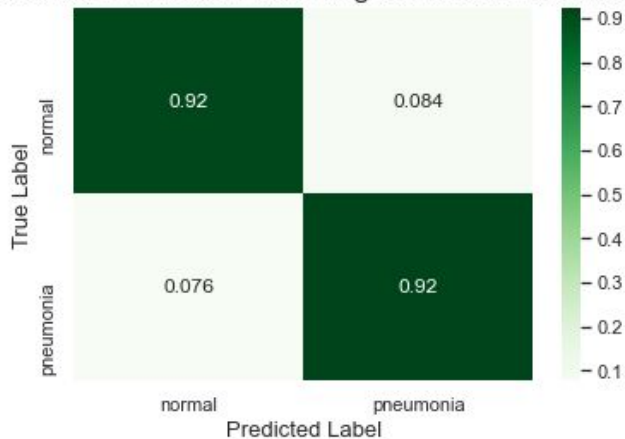## Oversample the data to correct for class imbalance
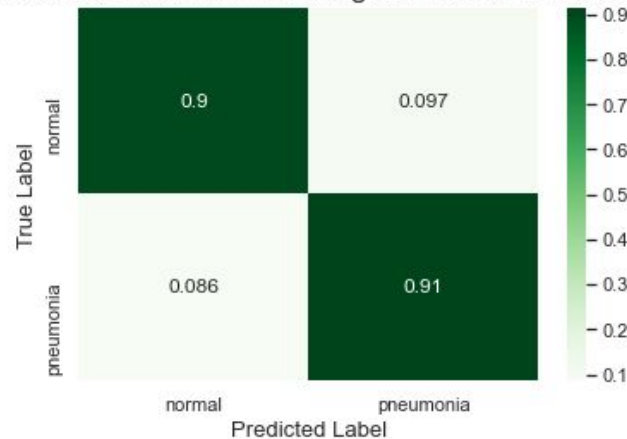
Recommendation 3:
Use image size to your advantage

Confusion Matrix For 128 Pixel Images With ReLU CNN Model

128 Pixels

Confusion Matrix For 32 Pixel Images With ReLU CNN Model

32 Pixels

Recommendations

- Use a simpler model
- Oversample the data to correct for class imbalance
- Use image size to your advantage based on the goals with using the model

Future Work

- Test out pretrained models for greater accuracy
- Continue testing different parameters or options
- Add more data!
  - Train the model to predict adult X-ray images?

Thank you for your time

Any questions?

Appendix

Use a simpler model

Comparison of layers

Layer (type)	Output Shape	Param #
conv2d_9 (Conv2D)	(None, 96, 96, 32)	4736
max_pooling2d_7 (MaxPooling2	(None, 48, 48, 32)	0
conv2d_10 (Conv2D)	(None, 48, 48, 64)	18496
conv2d_11 (Conv2D)	(None, 48, 48, 64)	36928
max_pooling2d_8 (MaxPooling2	(None, 24, 24, 64)	0
conv2d_12 (Conv2D)	(None, 24, 24, 128)	73856
conv2d_13 (Conv2D)	(None, 24, 24, 128)	147584
max_pooling2d_9 (MaxPooling2	(None, 12, 12, 128)	0

Layer (type)	Output Shape	Param #
conv2d_68 (Conv2D)	(None, 96, 96, 64)	9472
max_pooling2d_57 (MaxPooling	(None, 48, 48, 64)	0
conv2d_69 (Conv2D)	(None, 48, 48, 128)	73856
max_pooling2d_58 (MaxPooling	(None, 24, 24, 128)	0

Complex   Simple

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