

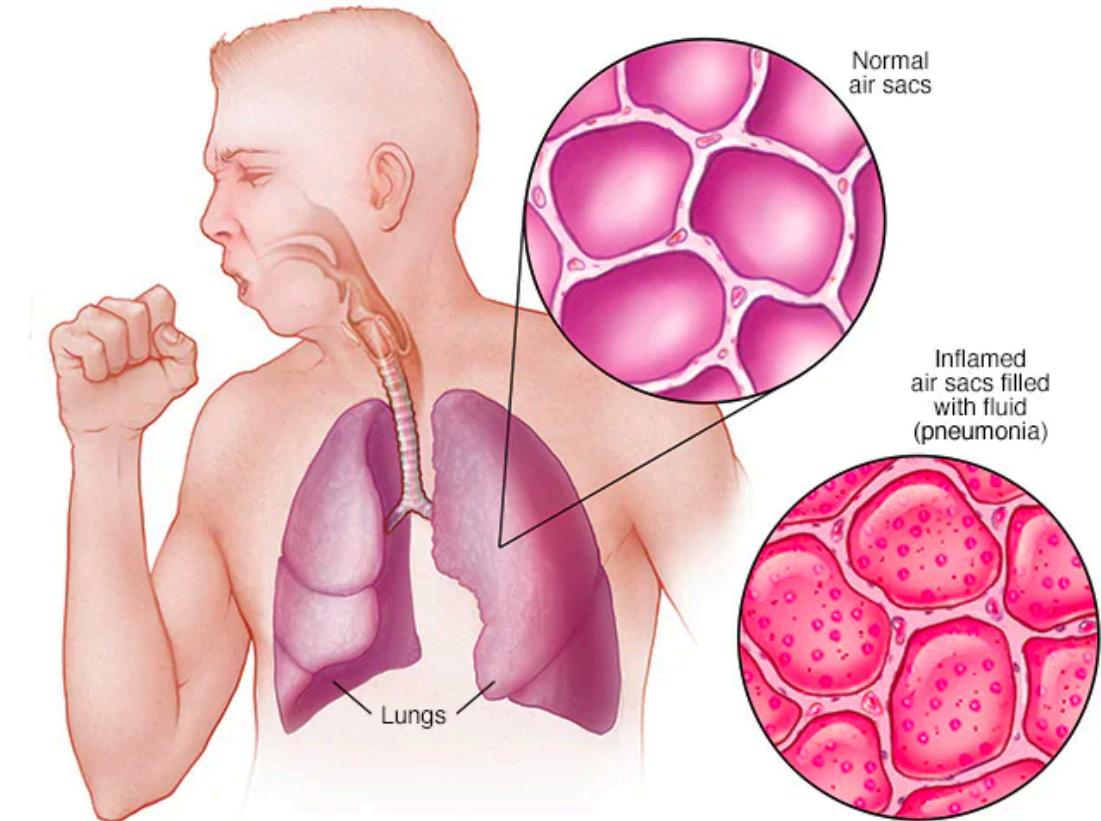
# Diagnosing Pneumonia using AI

A Convolution Neural Network Model from Chest X-Ray  
Images

by Nadir Sarigul

# Business Problem

- ✓ Pneumonia is an inflammatory disease of the lung usually caused by infection with viruses or bacteria
- ✓ Affects about 450 million people globally (7% of the population) and results in about 4 million deaths
- ✓ It can be treated if diagnosed at early stages but it is lethal if not treated

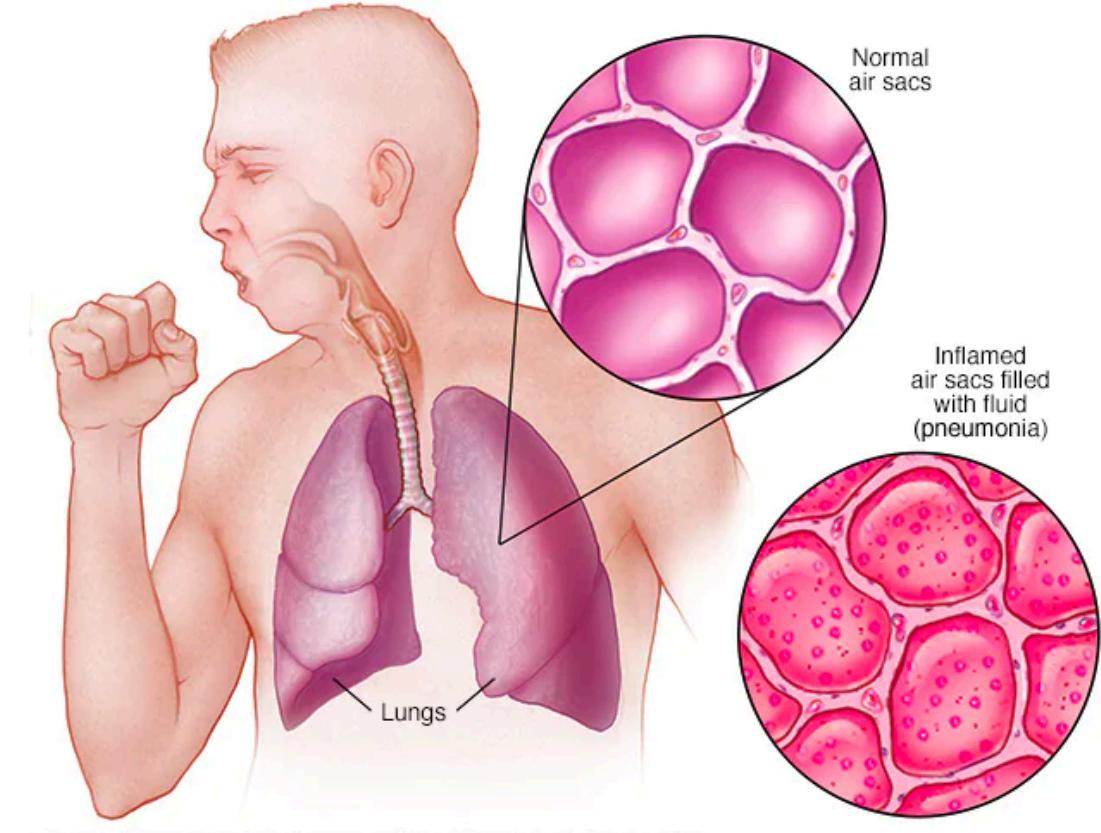


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# Business Problem

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Can we use AI to streamline pneumonia diagnosis?



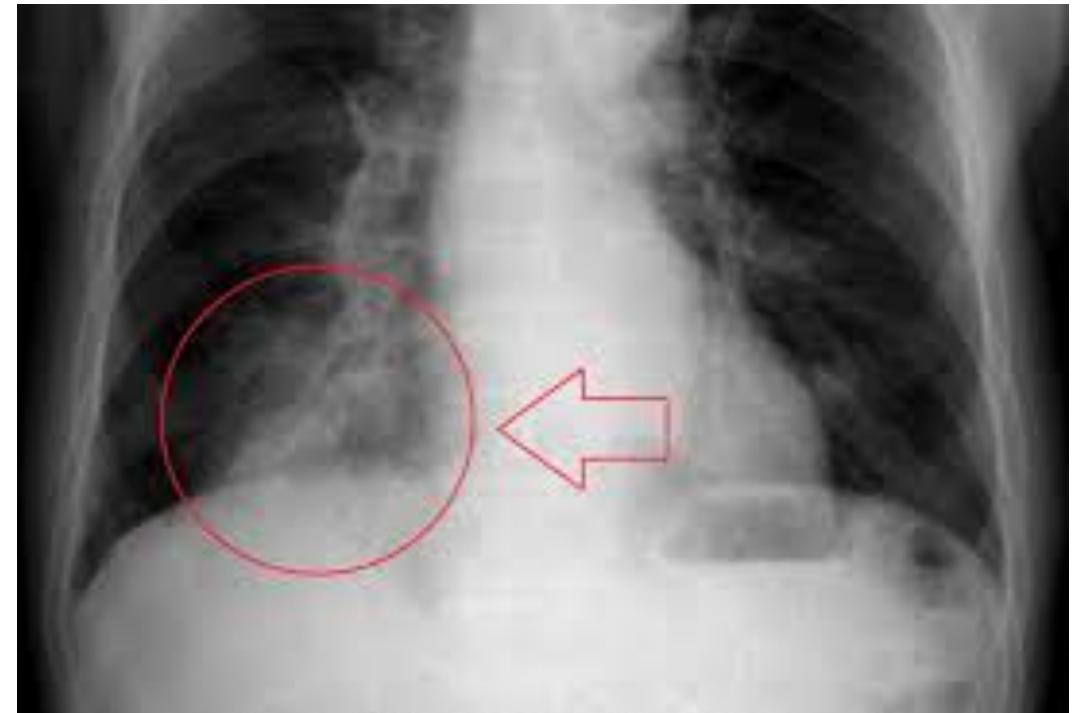
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# Pneumonia can be diagnosed by X-Ray imaging

## How is pneumonia diagnosed?

- ✓ Doctors evaluation of patient and symptoms

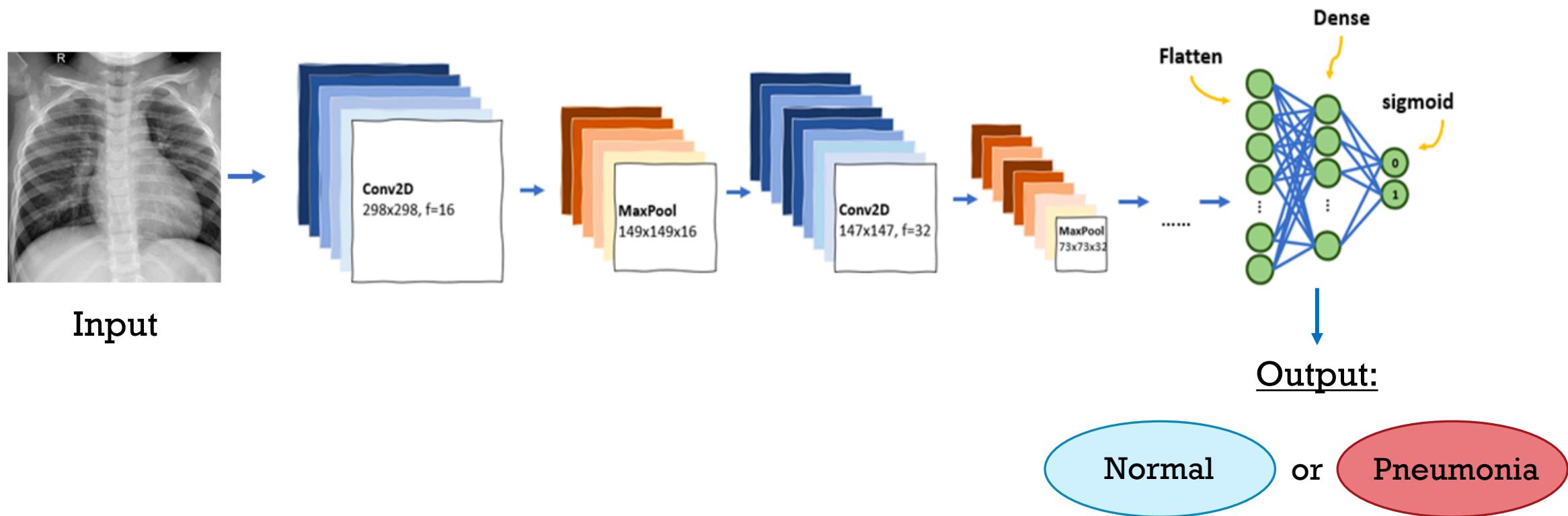
- ✓ X-ray imaging  
Looking for infiltrates in the lungs  
(shown as white spots in the x-ray)



Can the x-rays be used to generate an automated model for pneumonia diagnosis?

# The Solution:

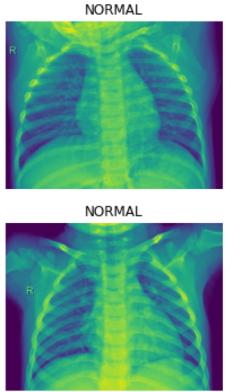
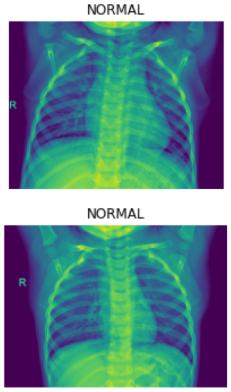
## Convolutional Neural Network Predictive Model



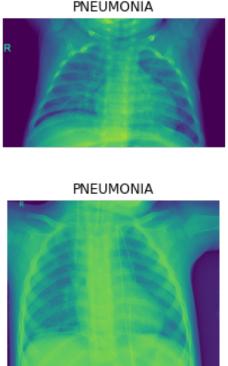
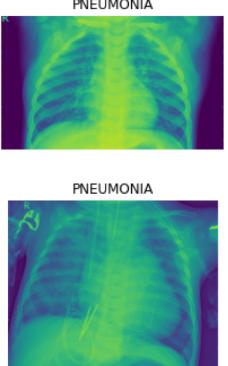
# The Solution:

Input

1575 normal x-rays



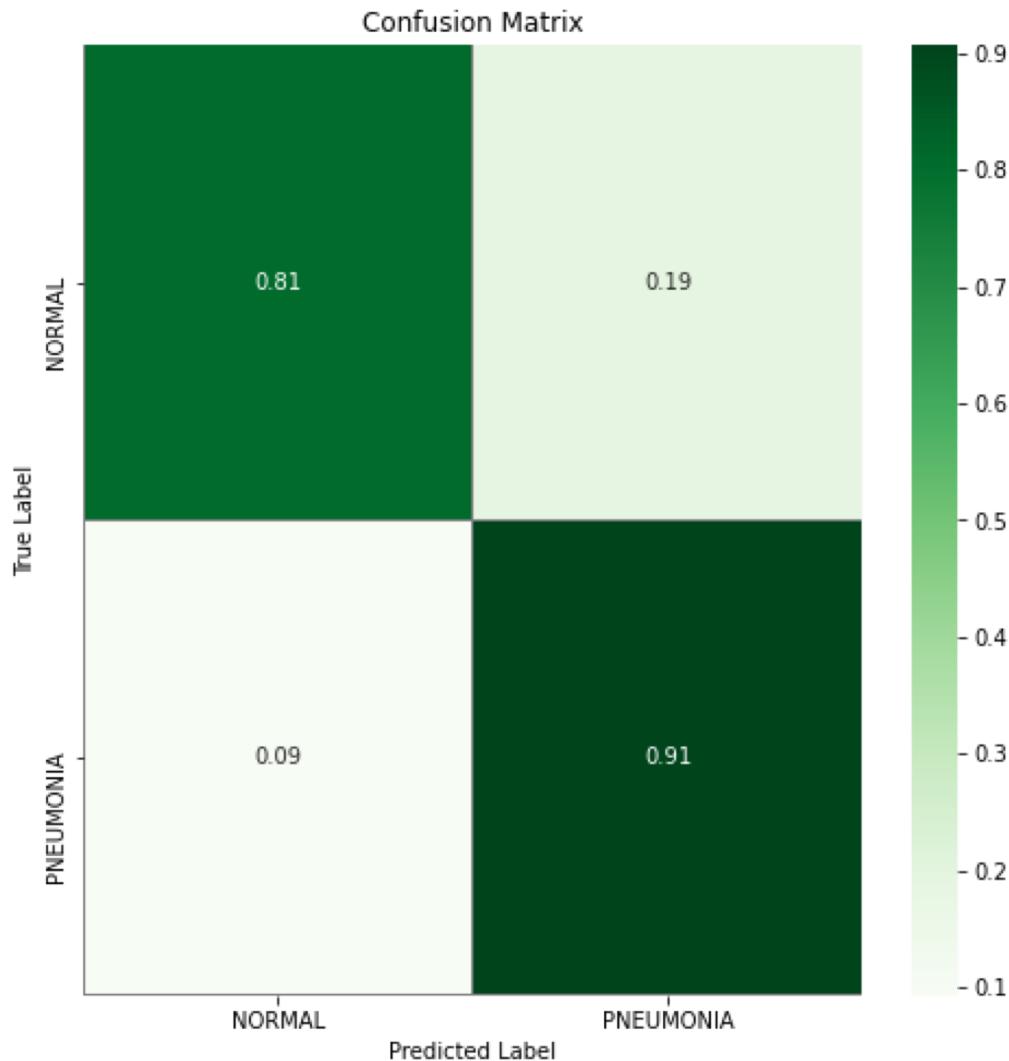
4265 pneumonia x-rays



CNN

Model: "sequential_2"		
Layer (type)	Output Shape	Param #
conv2d_7 (Conv2D)	(None, 64, 64, 32)	896
max_pooling2d_7 (MaxPooling2D)	(None, 32, 32, 32)	0
conv2d_8 (Conv2D)	(None, 32, 32, 64)	18496
max_pooling2d_8 (MaxPooling2D)	(None, 16, 16, 64)	0
conv2d_9 (Conv2D)	(None, 16, 16, 128)	73856
max_pooling2d_9 (MaxPooling2D)	(None, 8, 8, 128)	0
conv2d_10 (Conv2D)	(None, 8, 8, 128)	147584
max_pooling2d_10 (MaxPooling2D)	(None, 4, 4, 128)	0
flatten_2 (Flatten)	(None, 2048)	0
dense_7 (Dense)	(None, 128)	262272
dropout (Dropout)	(None, 128)	0
dense_8 (Dense)	(None, 256)	33024
dense_9 (Dense)	(None, 512)	131584
dense_10 (Dense)	(None, 1)	513
Total params: 668,225		
Trainable params: 668,225		
Non-trainable params: 0		

# Does it work?



**It works!**

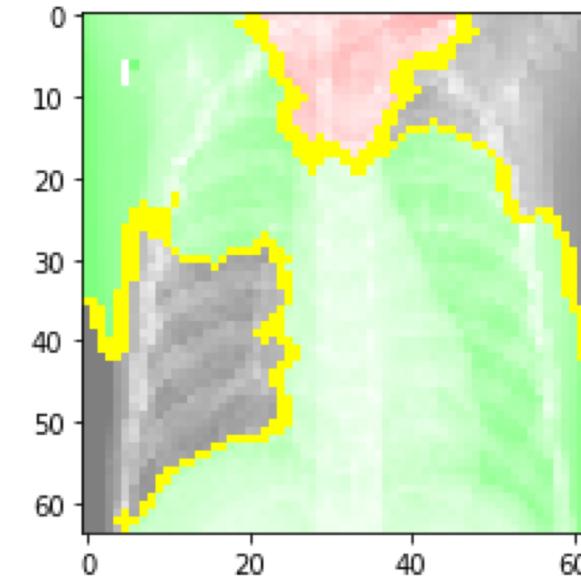
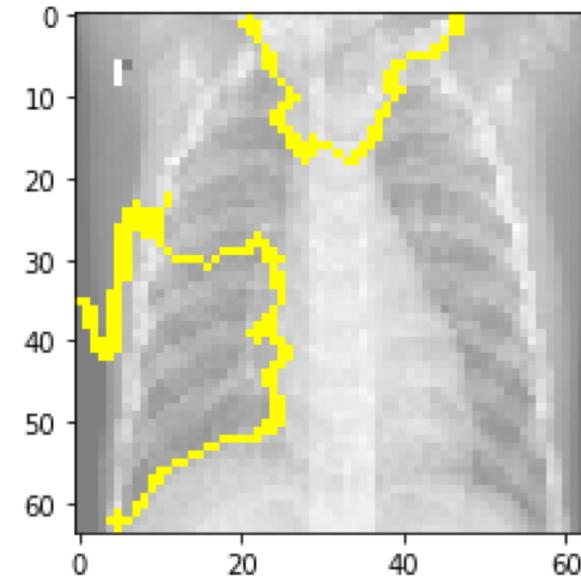
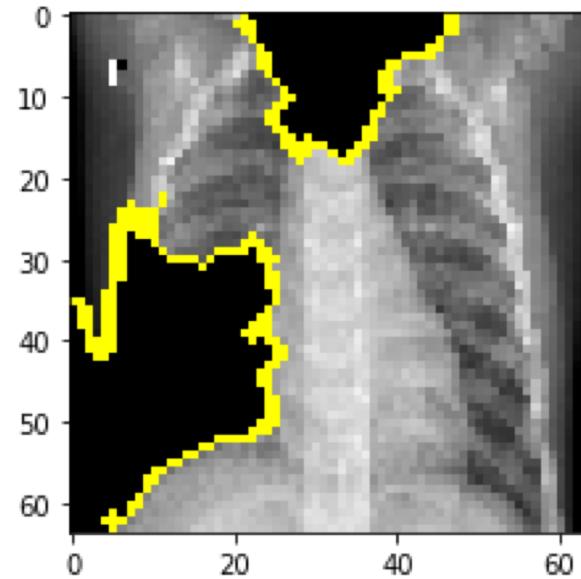
**Model has 87% accuracy!**

**Predicts:**

**✓ 91% of pneumonia cases**

**✓ 81% of healthy cases**

# Why can't we predict 100% of the cases?



Noise from diaphragm and sternum cause misdiagnosis!

# Conclusions

- ✓ Chest x-ray images can be used to develop AI-based diagnostic models
- ✓ The diaphragm and sternum areas are a source of noise that affects the ability of the model to correctly diagnose patients



# Recommendations

## Streamline Pneumonia Diagnosis with AI

- ✓ Develop a pre-processing tool that removes the noise coming from the diaphragm and sternum areas which is done automatically as part of the x-ray processing
- ✓ Implement the AI model automatically once the x-ray image is generated and processed as a first step in the diagnosis of pneumonia to help inform the radiologist that interprets the x-ray



Questions?

