A Civic Developers Quest to Change Healthcare

A guide by Luther Hill

Healthcare in crisis

HUMAN
SOLVING THE GLOBAL
WORKFORCE CRISIS
IN HEALTHCARE

MARK BRITNELL

"**Most Americans Believe Health Care is in Crisis.Seventy percent of Americans believe the country's health care system has major problems.**"

US World news

Agenda

➜ **0900-0950: Intro & Setup**

➜ **1000-1050: Build & iterate model**

➜ **1100-1150: Deploy model to webapp**

➜ **1200-1230: All the things I learned**

➜ **1230-1250: conclusion**

Specifications

The following requirements are needed to complete this training session.

1.   Computer
2.   Internet connection
     a.   Conference wifi name: xxxxxxxxx
     b.   Conference wifi password: xxxxxxx
3.   Access to Google collab
     https://colab.research.google.com/
4.   Helpful if you are familiar with fastai.
     https://course.fast.ai/index.html
5.   Clone my conference repository.
     https://github.com/lutherkhill/codemash2020
6.   Access to kaggle
     https://www.kaggle.com/nih-chest-xrays/data
7.   ChestX-ray8: Hospital-scale Chest X-ray Database
     and Benchmarks on Weakly-Supervised
     Classification and Localization of Common Thorax
     Diseases

United States
States with Medically Underserved Areas Designated by U.S. Government for 2013 }
Numbers represent Primary Medical Care shortage records by state.
Source: U.S. Dept. of Health & Human Services Health Resources & Services Administration

Midwest & Central

Northwest & West

Idaho: 105
Wyoming: 62

Illinois: 1,299
Missouri: 537
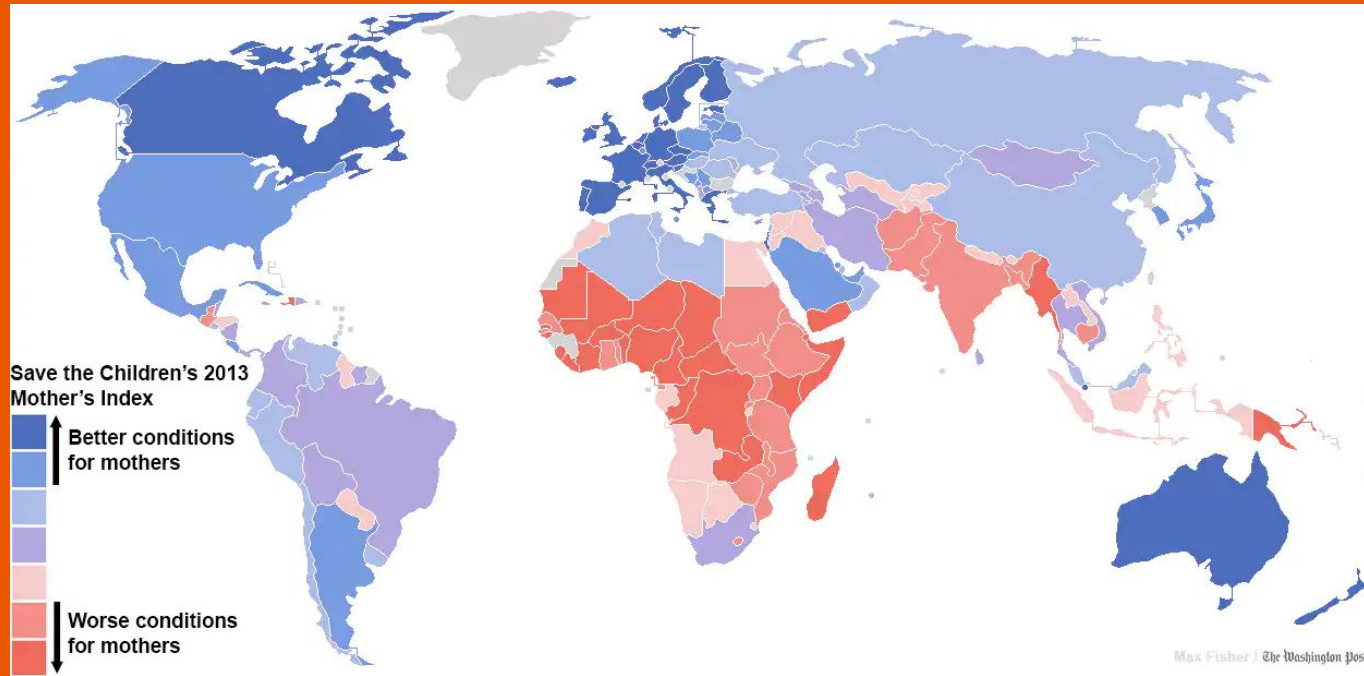Oklahoma: 237
North Dakota: 502

Arizona: 682
New Mexico: 172

Alabama: 284
Louisiana: 215
Mississippi: 140
South Carolina: 189

Southwest

Southeast

Our problem

This is not a developing world problem.

This our problem!.

Save the Children's 2013 Mother's Index

Better conditions for mothers

Worse conditions for mothers

Max Fisher / The Washington Post

The life expectancy of the average American has decrease in the last 3 years.

Description of 14 NIH labels

1. Atelectasis
2. Consolidation
3. Infiltration
4. Pneumothorax
5. Edema
6. Emphysema
7. Fibrosis
8. Effusion
9. Pneumonia
10. Pleural_thickening
11. Cardiomegaly
12. Nodule Mass
13. Hernia
14. No Findings

Atelectasis

Atelectasis is collapse of lung tissue with loss of volume. Patients may have dyspnea or respiratory failure if atelectasis is extensive. They may also develop pneumonia. Atelectasis is usually asymptomatic, but hypoxemia and pleuritic chest pain may be present in certain cases.
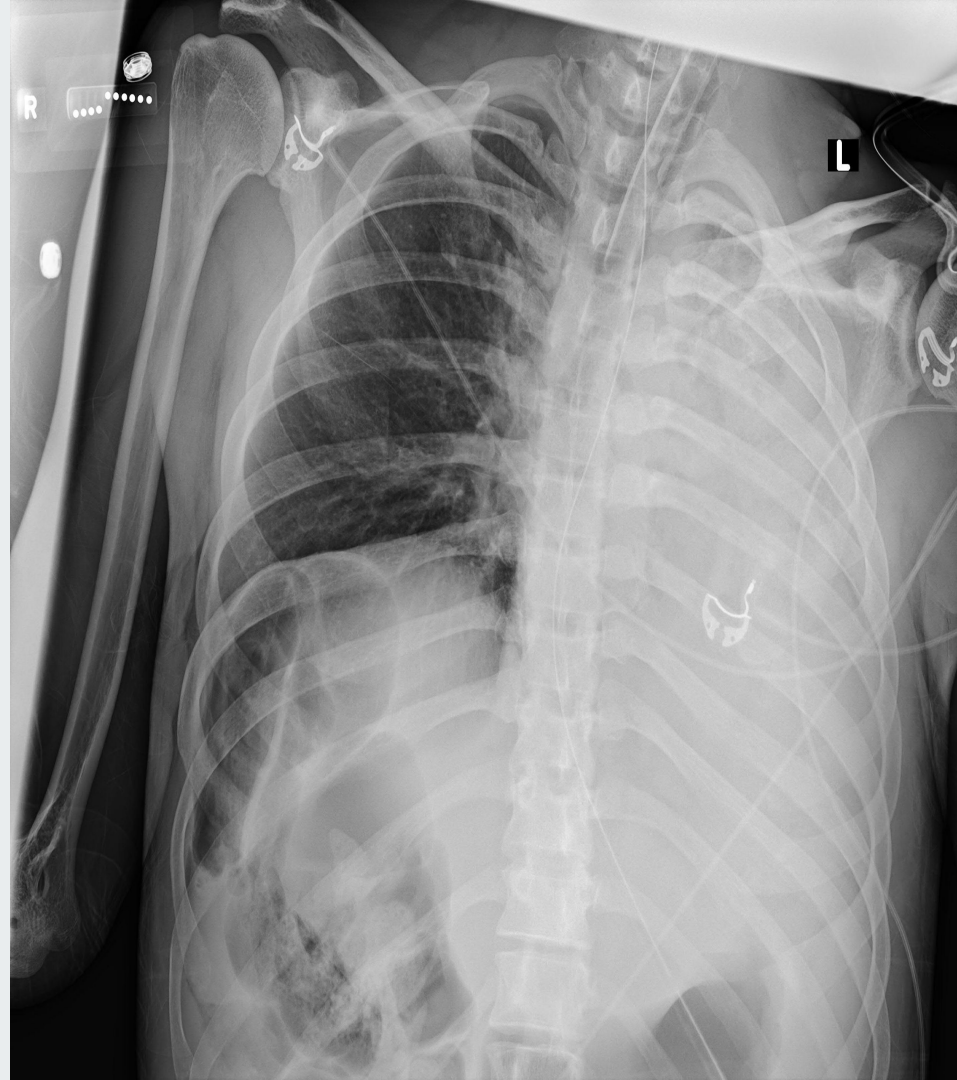
Consolidation

A pulmonary consolidation is a region of normally compressible lung tissue that has filled with liquid instead of air. The condition is marked by induration (swelling or hardening of normally soft tissue) of a normally aerated lung. It is considered a radiologic sign.
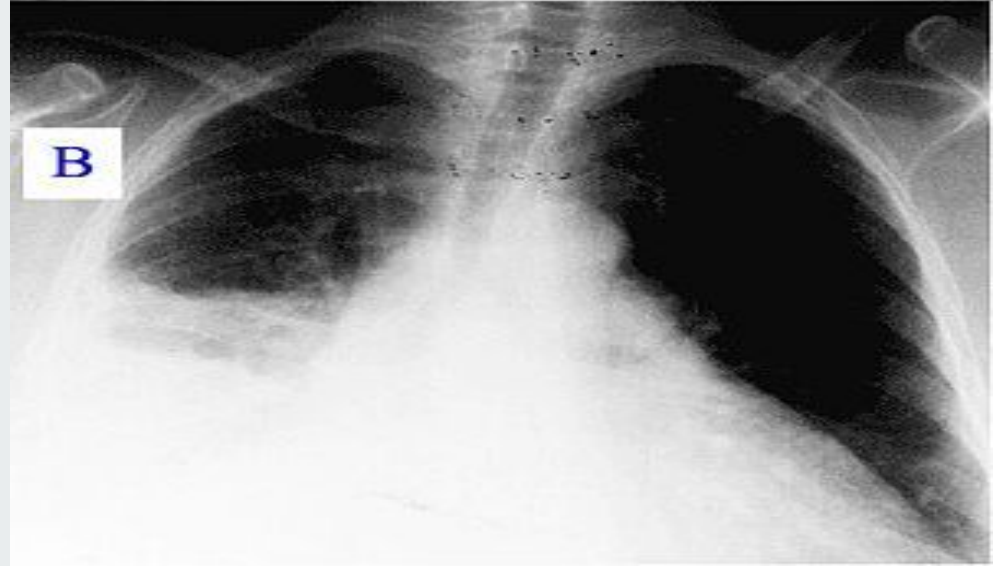
Inflitration

Infiltration is the diffusion or accumulation (in a tissue or cells) of foreign substances or in amounts in excess of the normal.

Pneumathorax

The diagnosis of pneumothorax is established by demonstrating the outer margin of the visceral pleura (and lung), known as the pleural line, separated from the parietal pleura (and chest wall) by a lucent gas space devoid of pulmonary vessels. The pleural line appears in the image below. A true pneumothorax line.
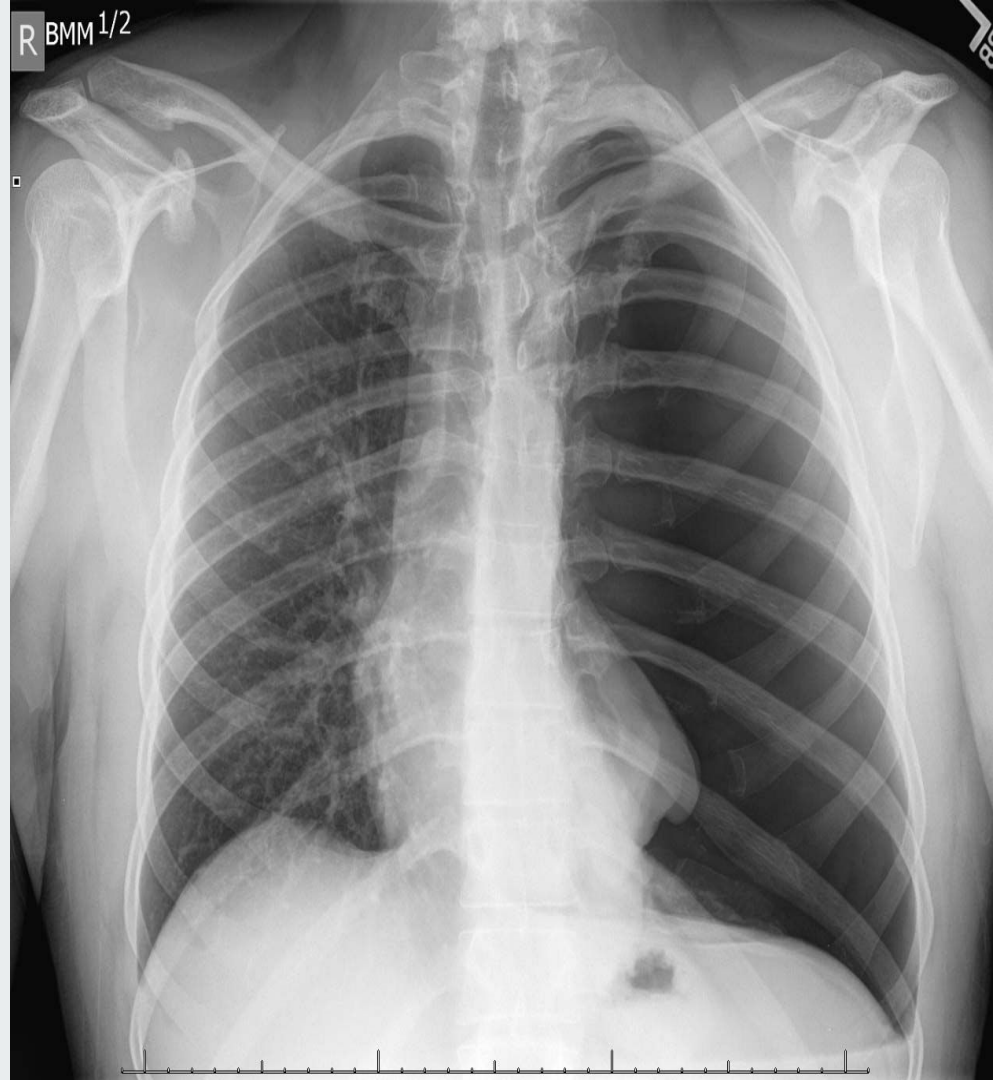
Edema

Fluid in your lungs include: Chest X-ray. A chest X-ray will likely be the first test you have done to confirm the diagnosis of pulmonary edema and exclude other possible causes of your shortness of breath
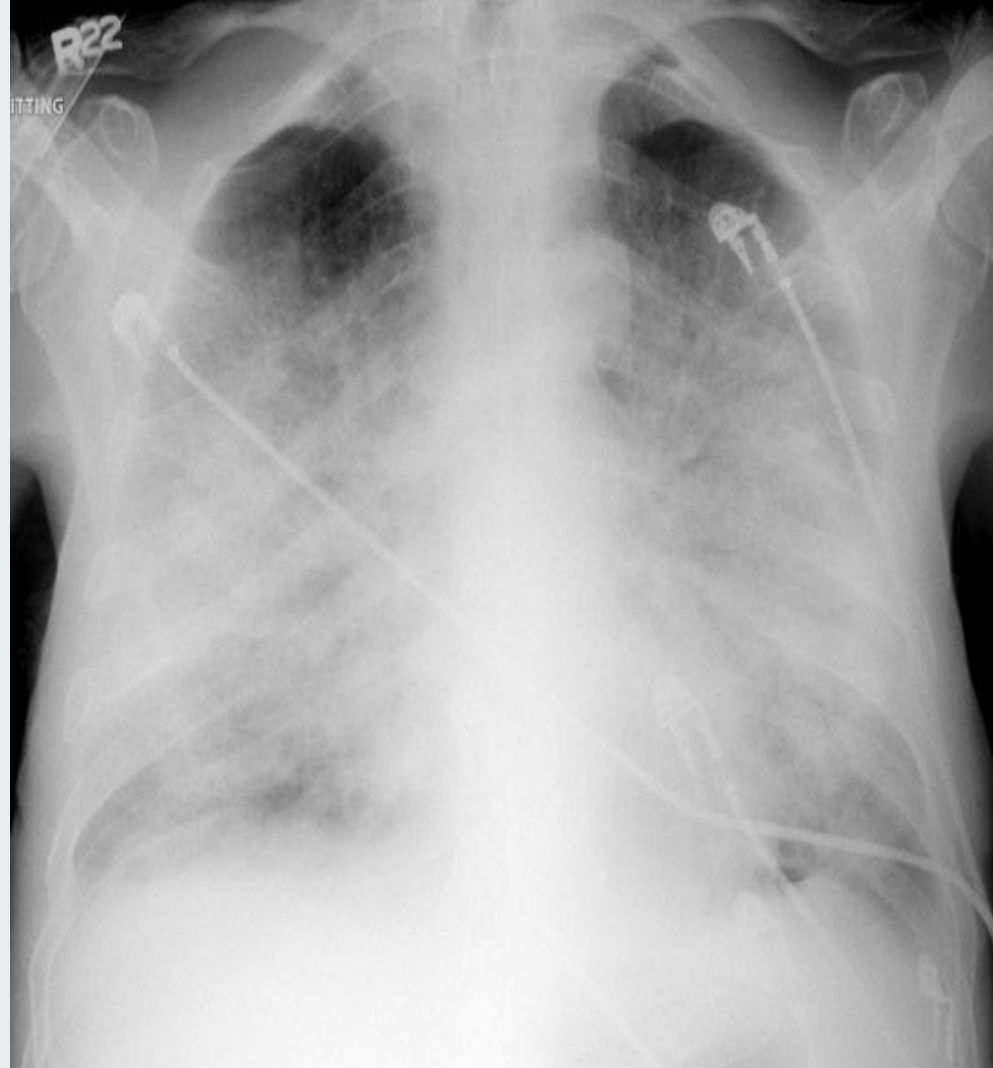
Emphysema

Emphysema is a type of COPD involving damage to the air sacs (alveoli) in the lungs. As a result, your body does not get the oxygen it needs. Emphysema makes it hard to catch your breath. You may also have a chronic cough and have trouble breathing during exercise. The most common cause is cigarette smoking.

Fibrosis

Fibrosis is the formation of excess fibrous connective tissue in an organ or tissue in a reparative or reactive process. This can be a reactive, benign, or pathological state. In response to injury, this is called scarring.

Effusion

Effusion: Too much fluid, an outpouring of fluid. For example, a pleural effusion is an abnormal accumulation of fluid in the pleural space between the lungs and the chest wall, while a knee effusion is an abnormal amount of fluid in the knee joint. A hemorrhagic effusion contains blood in the fluid.
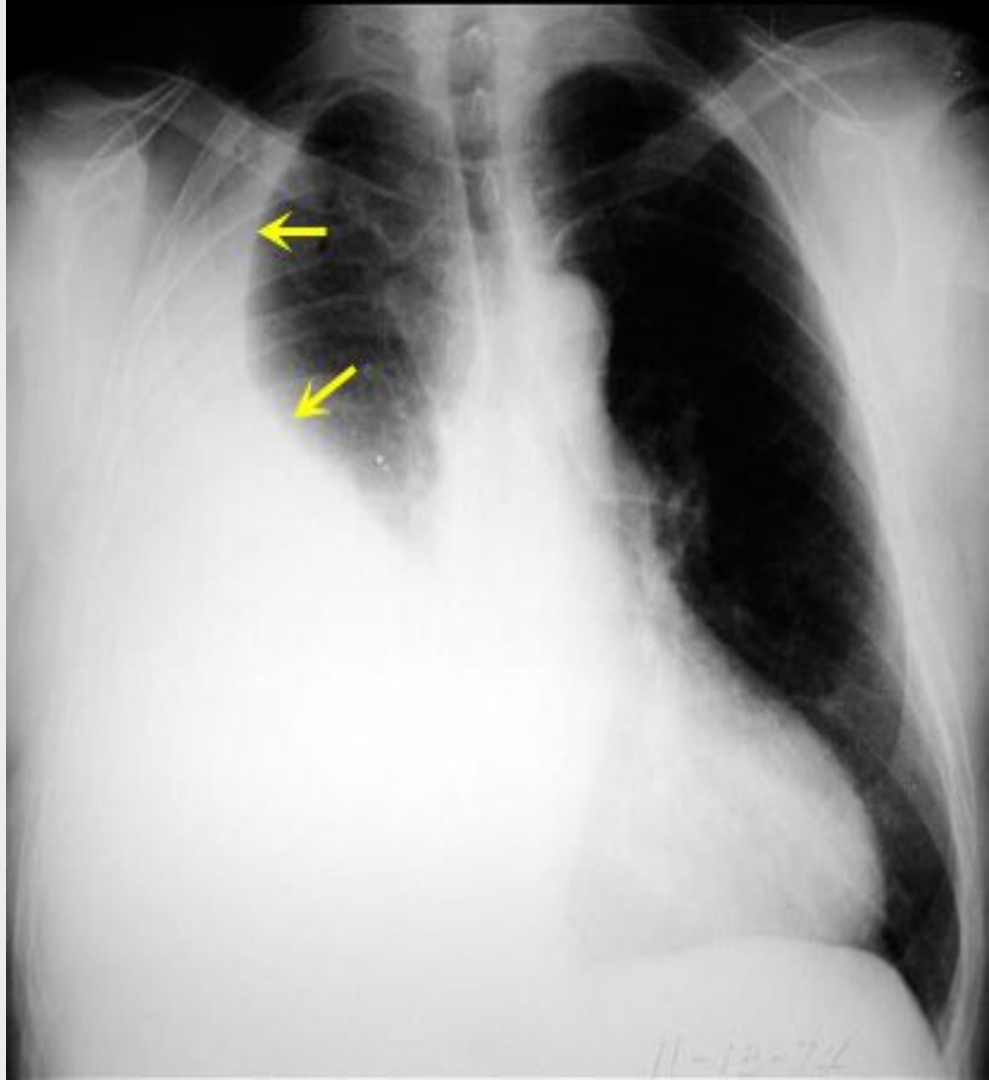
Pneumonia

Pneumonia is an infection that inflames the air sacs in one or both lungs. The air sacs may fill with fluid or pus (purulent material), causing cough with phlegm or pus, fever, chills, and difficulty breathing. A variety of organisms, including bacteria, viruses and fungi, can cause pneumonia.
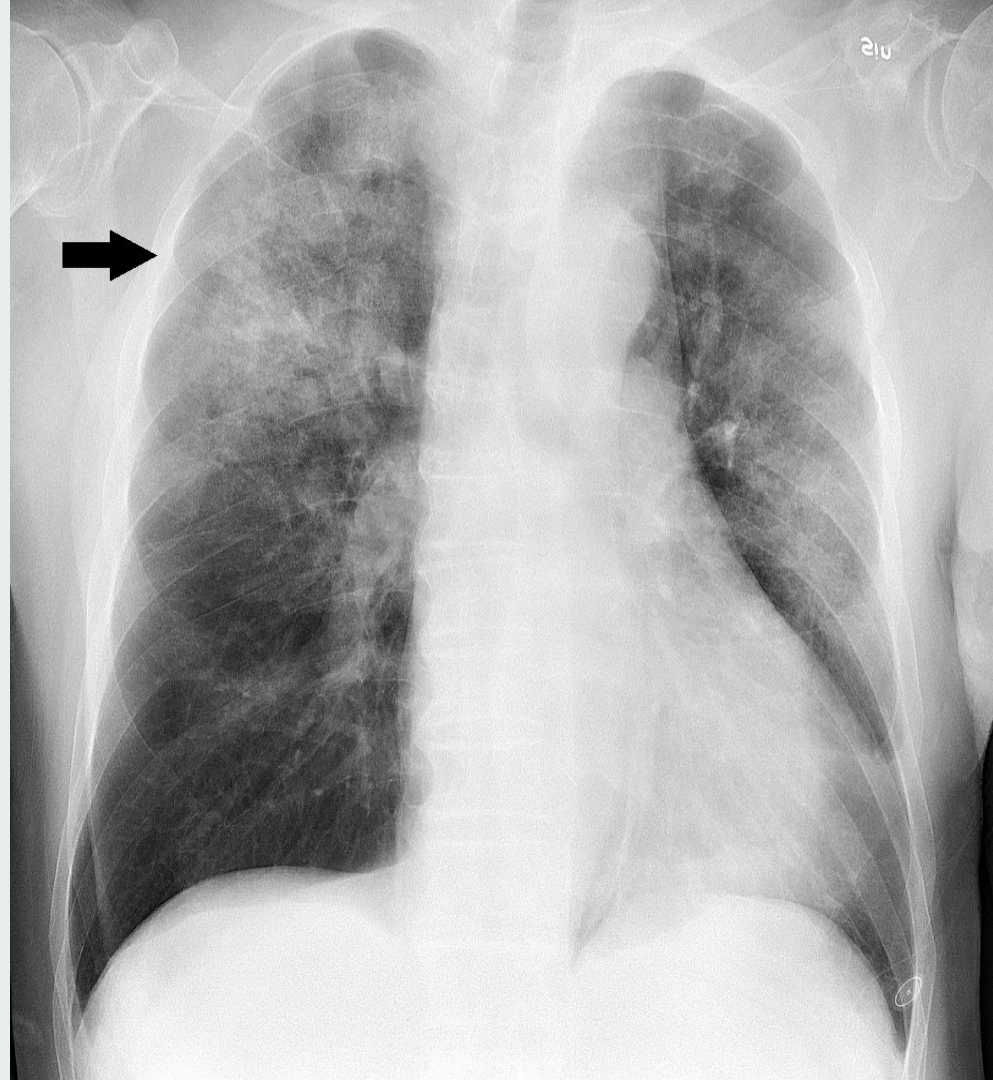
Pleural thickening

Pleural thickening, also known as diffuse pleural thickening, is a lung disease in which extensive scarring thickens the pleura, which is the lining of the lungs. The condition may cause chest pain and breathing difficulty, and it is one of the most commonly diagnosed signs of asbestos exposure.
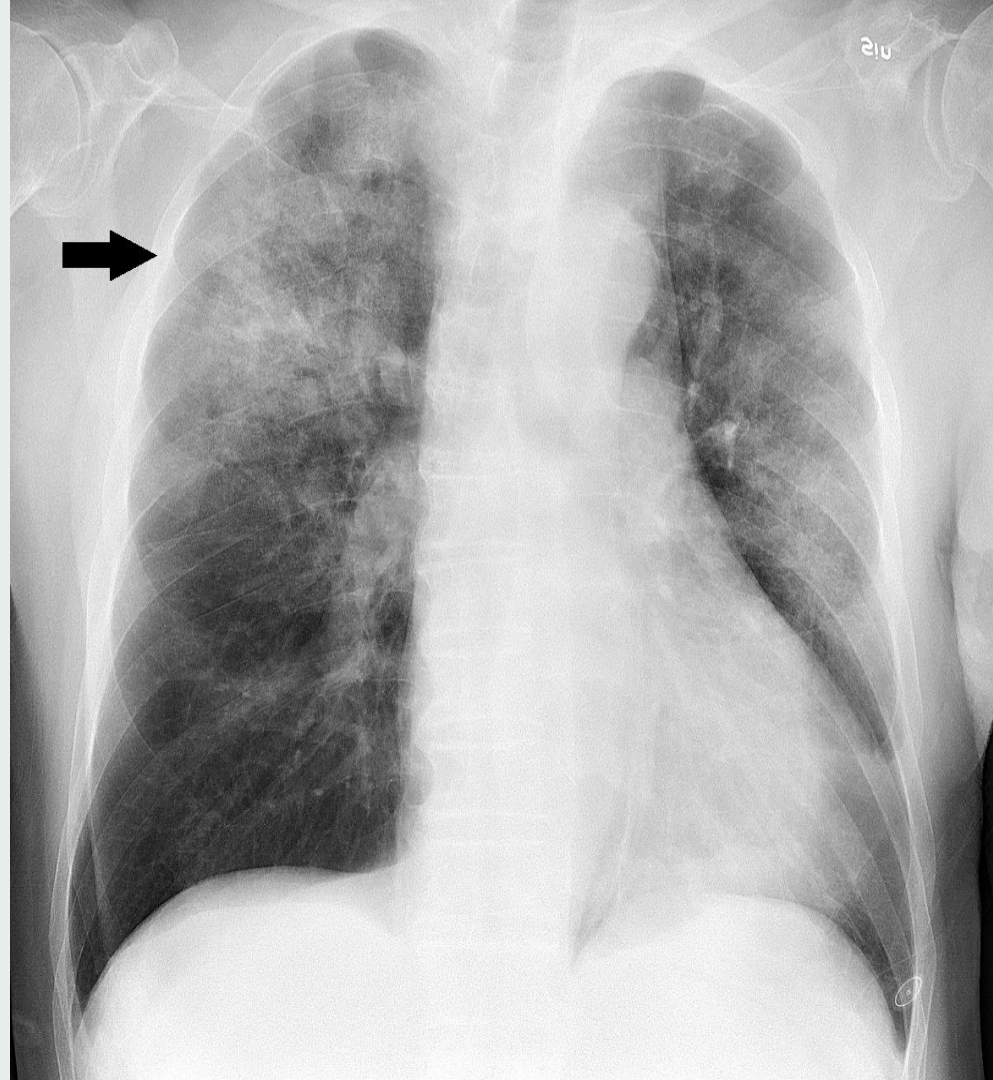
Cardiomegaly

Cardiomegaly is a medical condition in which the heart is enlarged. It is more commonly referred to as an enlarged heart. The causes of cardiomegaly may vary. Many times this condition results from high blood pressure (hypertension) or coronary artery disease.
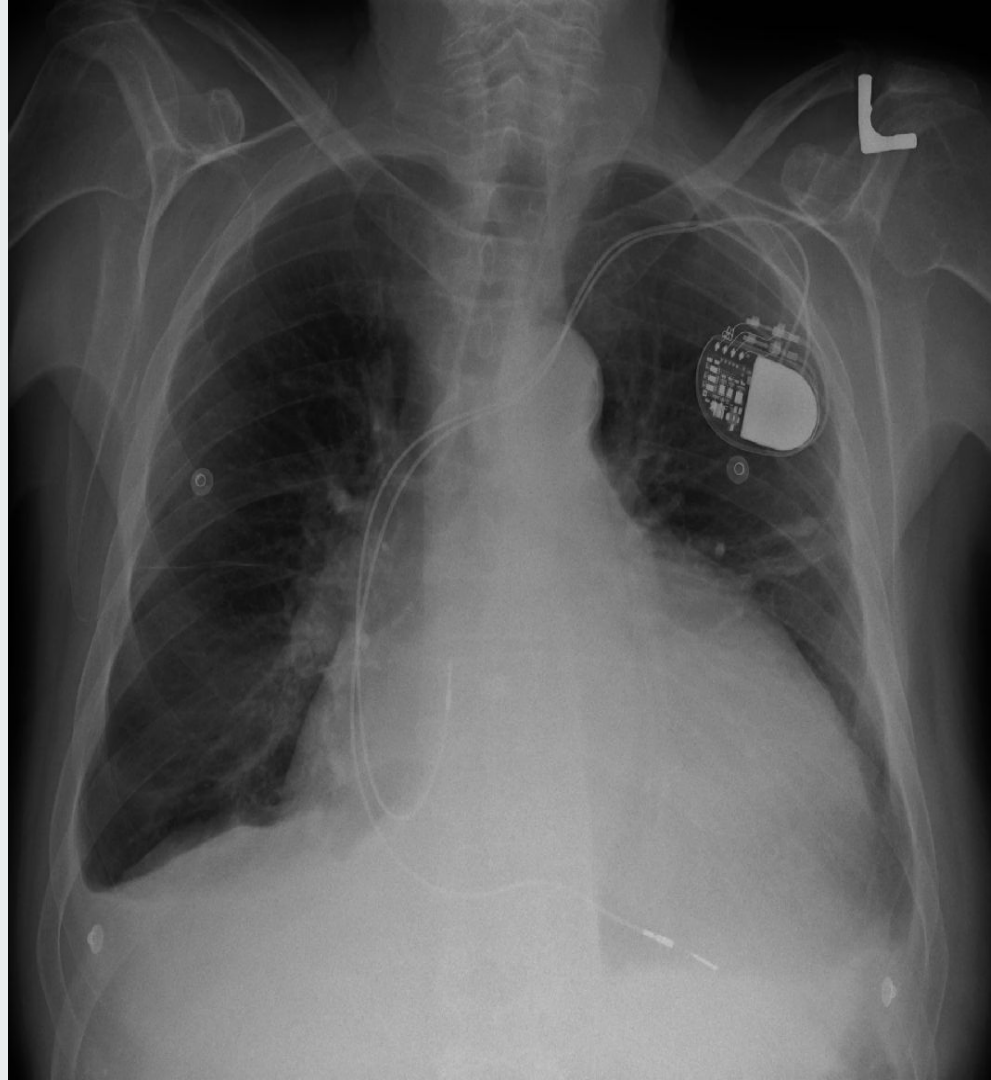
Nodele Mass

A nodule is a "spot on the lung," seen on an X-ray or computed tomography (CT) scan. In fact, a nodule shows up on about one in every 500 chest X-rays. Normal lung tissue surrounds this small round or oval solid overgrowth of tissue. It may be a single or solitary pulmonary nodule.
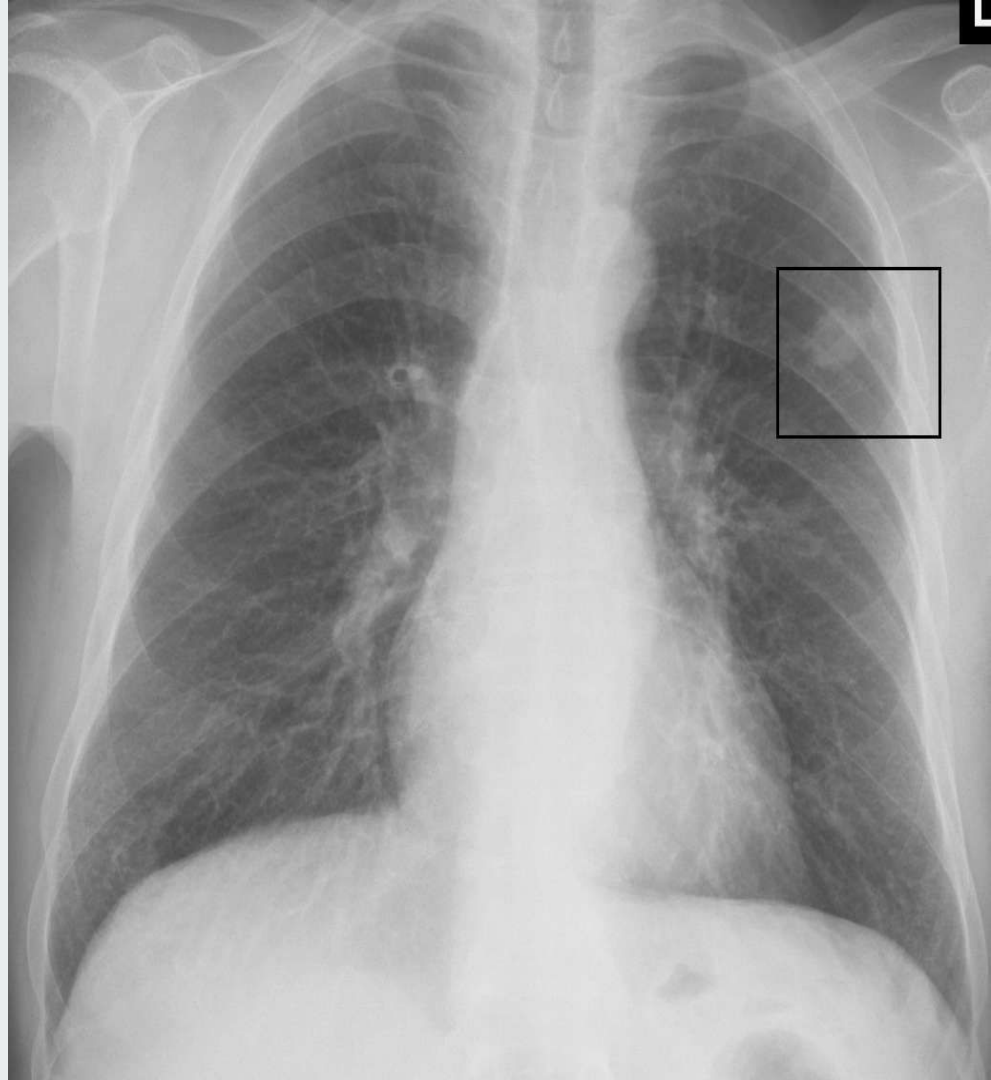
Hernia

A hernia occurs when an organ pushes through an opening in the muscle or tissue that holds it in place. For example, the intestines may break through a weakened area in the abdominal wall. Many hernias occur in the abdomen between your chest and hips, but they can also appear in the upper thigh and groin areas.
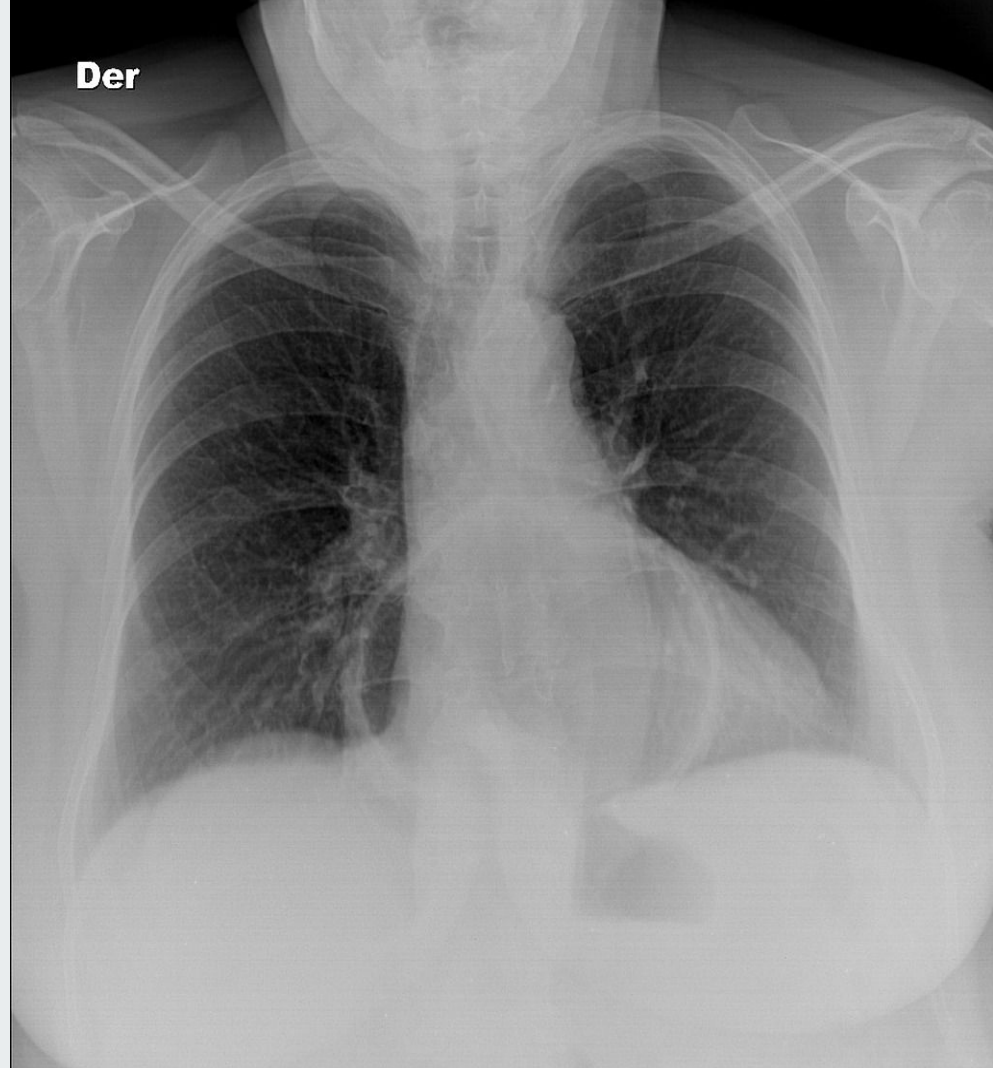
Making Choices

1. Deleted the following labels
   a. delete hernia- not clinically relevant
   b. delete pneumothorax- majority of images had chest tubes
   c. delete pneumonia, emphysema, and fibrosis : these are diagnosed clinically not based on imaging
2. I created the following classes
   a. Lung_disease: consolidation / infiltration / atelectasis / pneumonia/ effusion/ Pleural_Thickening
   b. Cardiomegaly
   c. Mass nodule

Working With Medical Images

1. Variance and invariance
2. Lack of labeled and segmented data
3. Lack of move fast and break things mentality

Variance and invariance
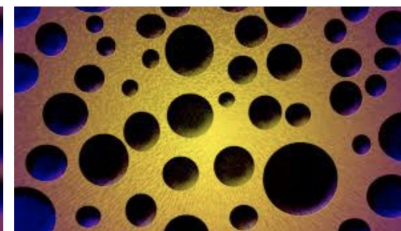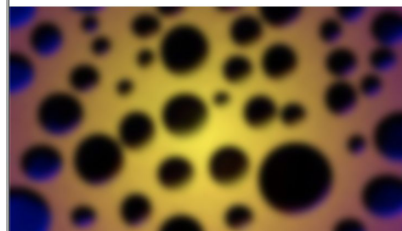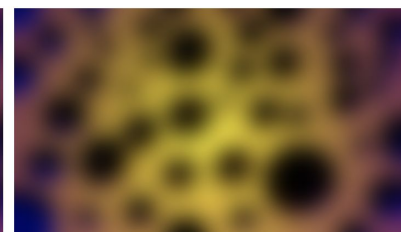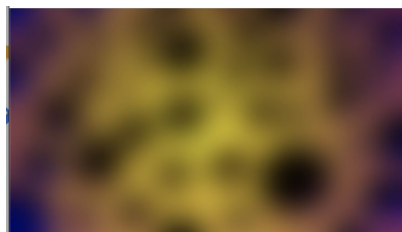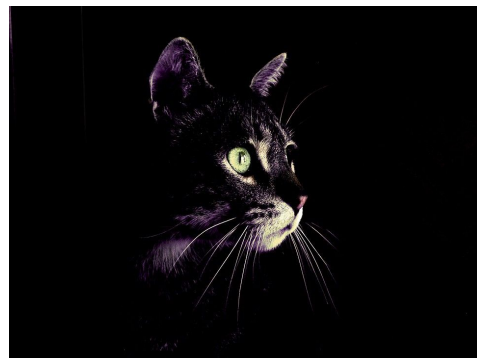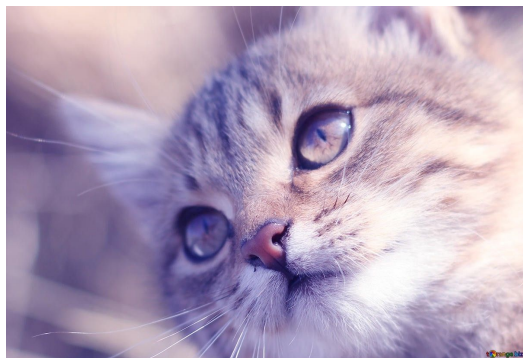
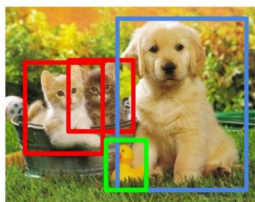Classification | Classification + Localization | Object Detection | Instance Segmentation
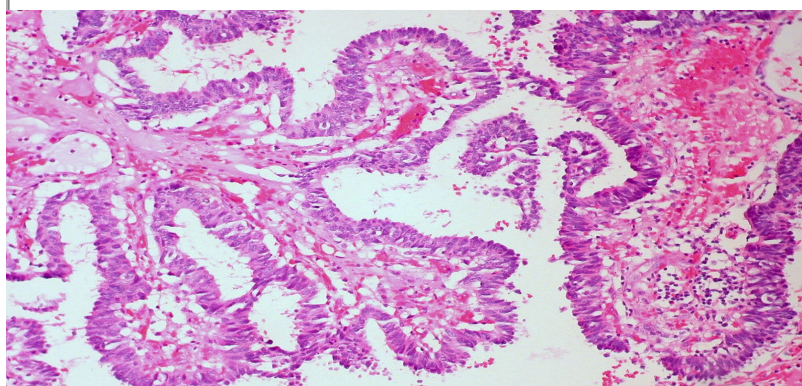
CAT | CAT | CAT, DOG, DUCK | CAT, DOG, DUCK

Single object | Multiple objects

6 things I learned along the way

1. Start small.
2. Always look at the data
3. You don't need domain expertise but you need domain understanding.
4. Not all measurement are created equal.
5. Pick something personal to you.
6. Be fearless.