A Sigh of Relief

Deep Learning to Aid the Diagnosis of Pneumonia

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Complexity

- Many different factors influence care.
- Many of our choices as clinicians are probabilistic, in nature.
- With the advent of EMRs
  Drowning in data
  Starving for insight

https://pixabay.com/en/photos/medical/

Role of Data Science?

Project Goal

- To build a screening tool for clinicians, using a Convolutional Neural Net model to detect opacity on X-rays.

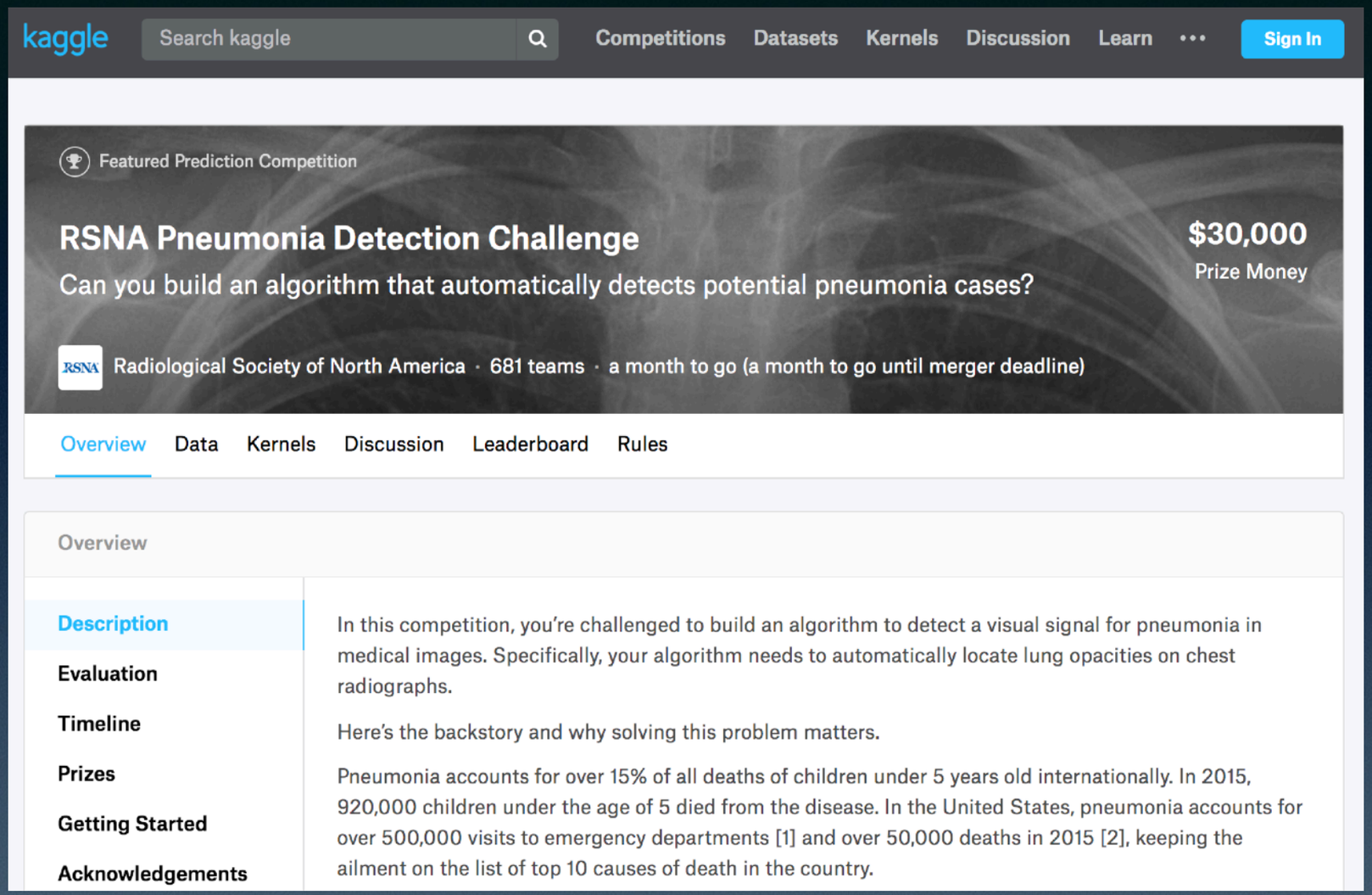
- Aid clinicians at the first point of care:
  Primary Care, Urgent Care, Emergency Room

- Wet reads guide treatment, awaiting radiologist's final report

- Early & accurate detection can hasten treatment & save lives!

- Aid Radiologists: Triage large volume of images

Pneumonia: A leading cause of morbidity and mortality



Kaggle Competition

Sponsored by the Radiological Society of North America

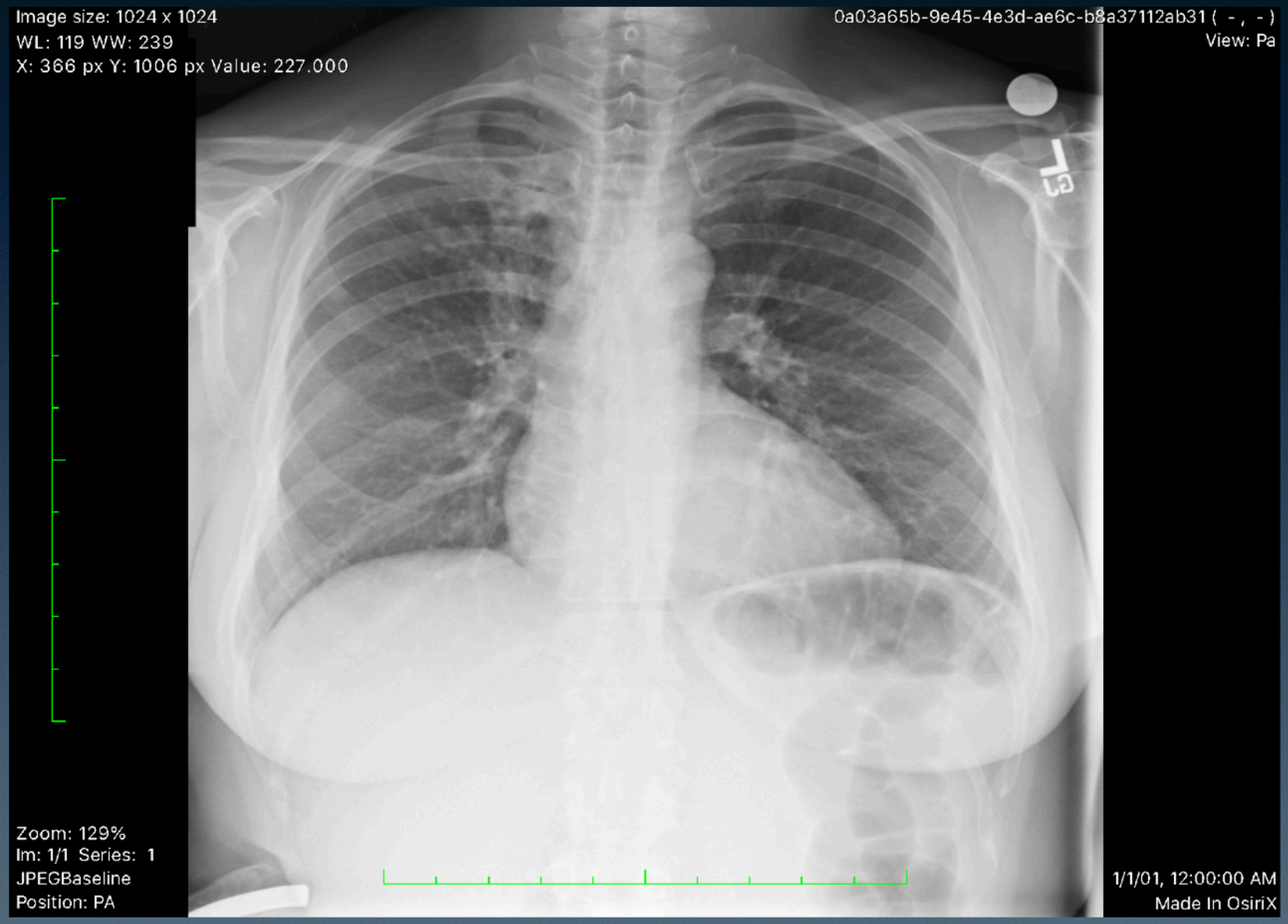
Pneumonia

https://www.123rf.com/stock-photo/pneumonia.html

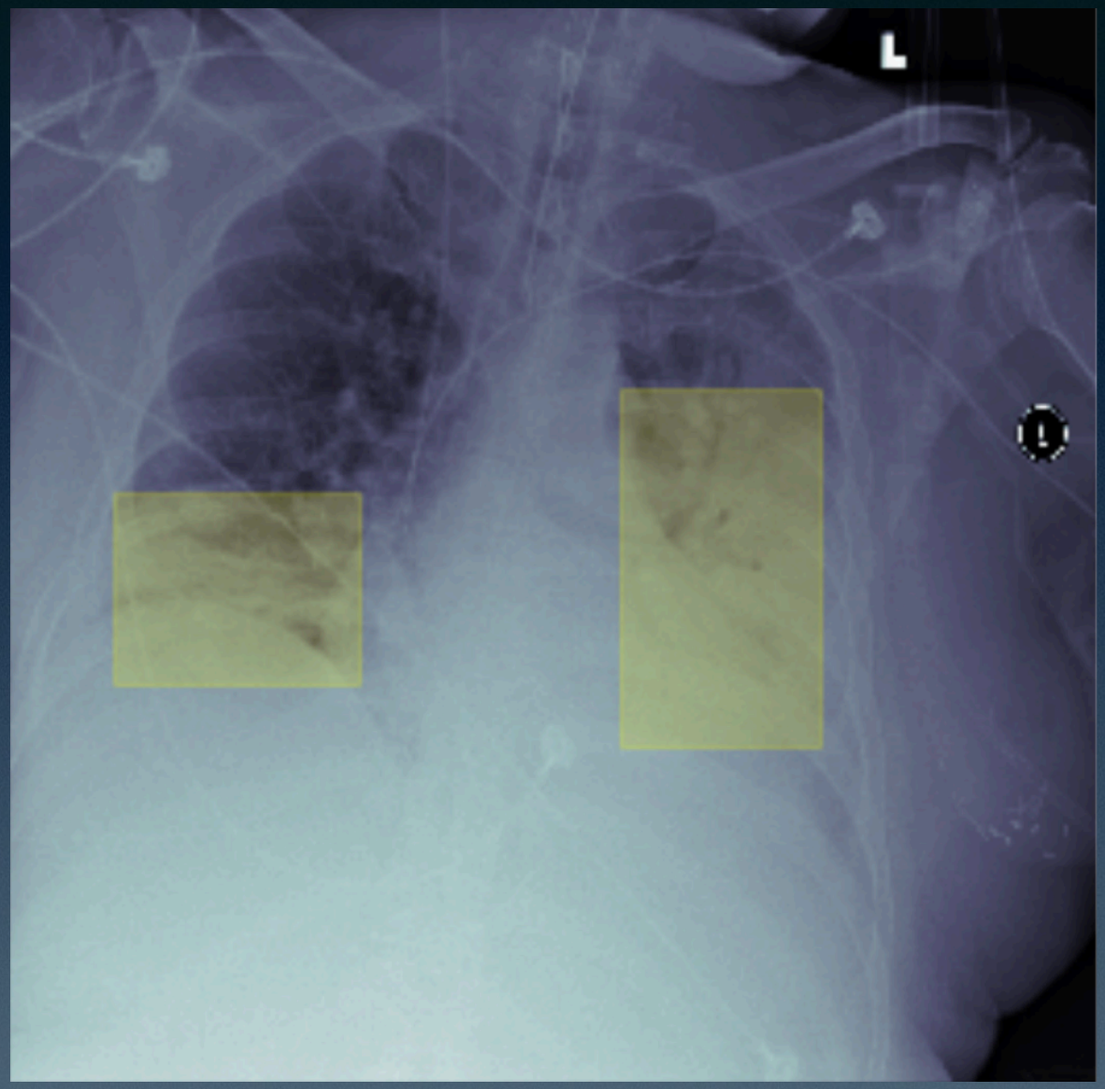
What does it look like on a Chest X-ray?

Medical Images

- Dicom Files (.dcm)
- Grayscale
- Embedded XML
  - eXtensible Markup Language
  - Real patients, De-identified
- Labels: Normal, Opacity, Not Normal / No Opacity
- Coordinates of Opacity



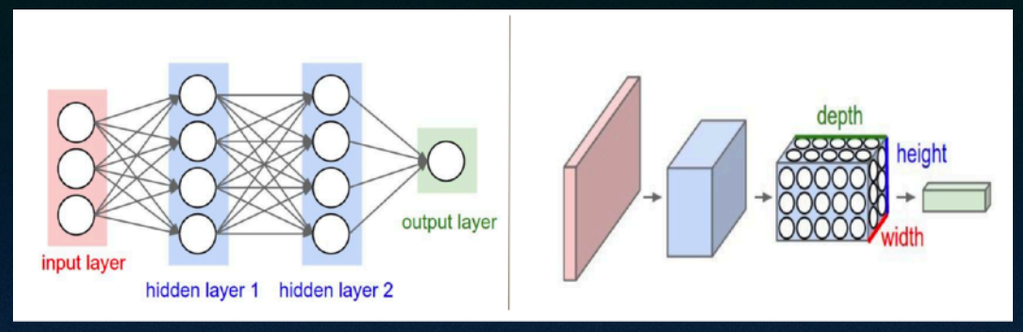
Segments

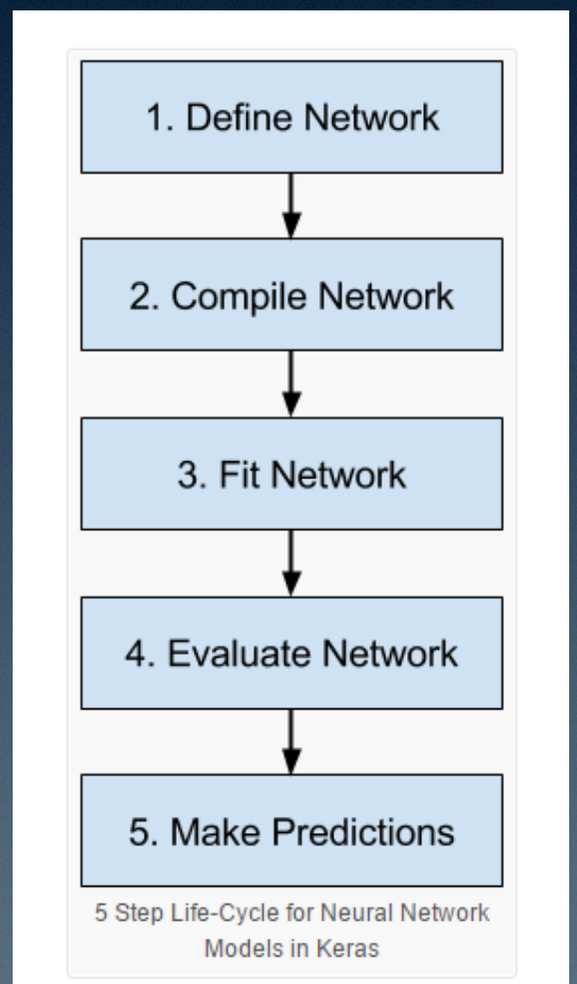


- Regions of Interest

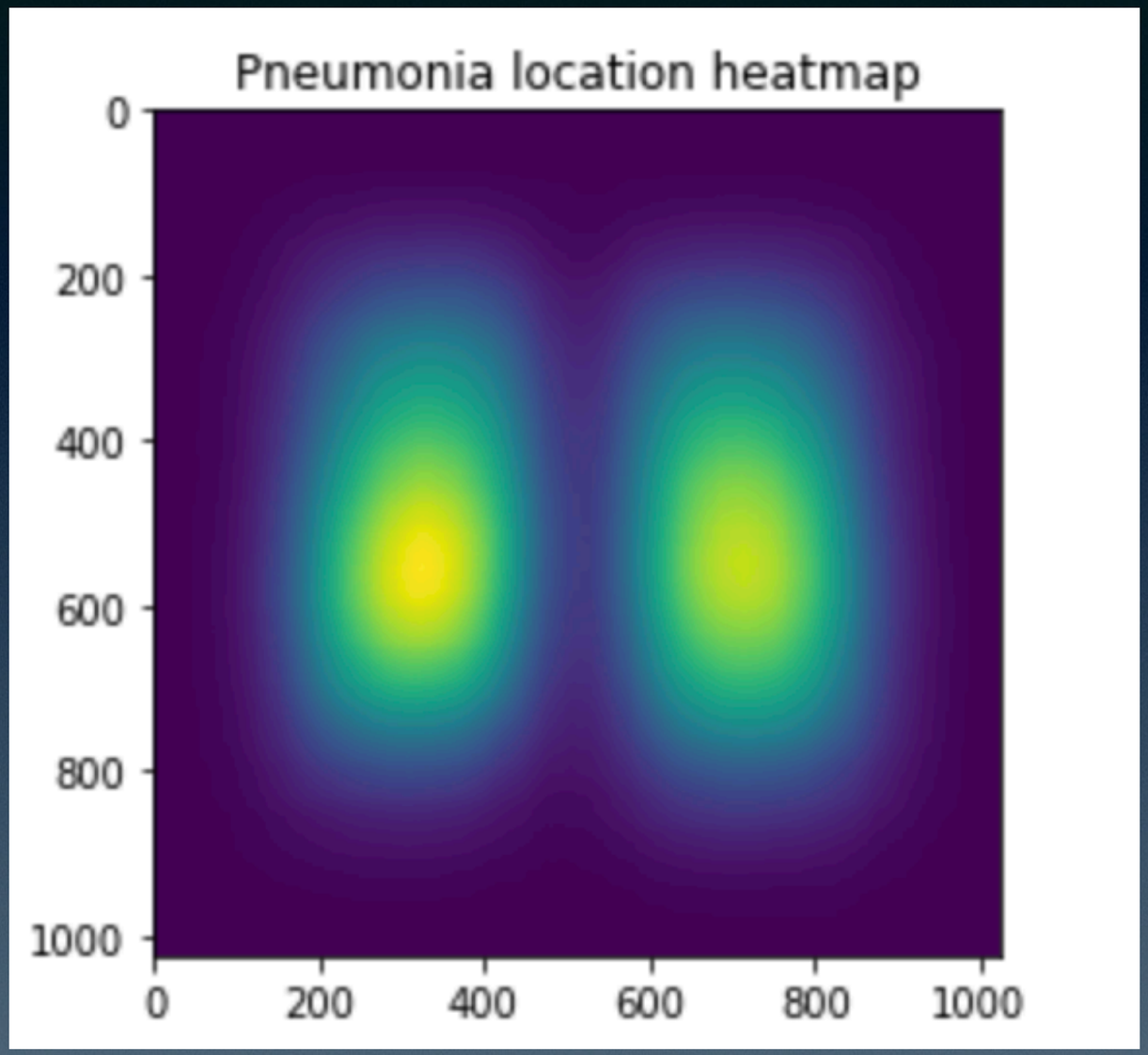
Convolutional Neural Net

- Set up AMI type EC2 instance on AWS: Deep Learning - Image Analysis
- XML data extraction with pyDicom
- Image pre-processing and visualization with pyDicom
- Convolutional Neural Net [CNN] model: Cases exist where CNNs outperform human vision- feature identification, image classification
- Transfer learning with VGG16 to train levels of CNN
- Improve model: augmentation
- Balance classes, Freeze, Unfreeze layers



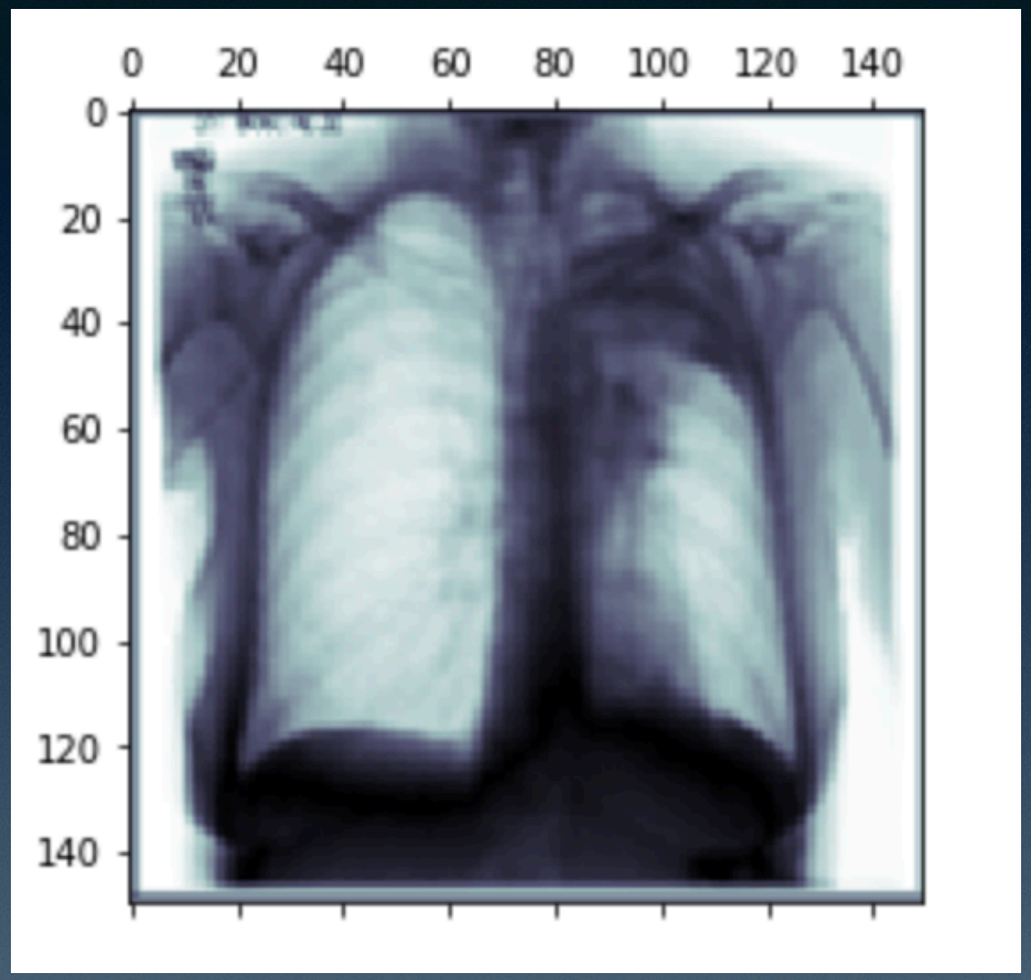


Concentration



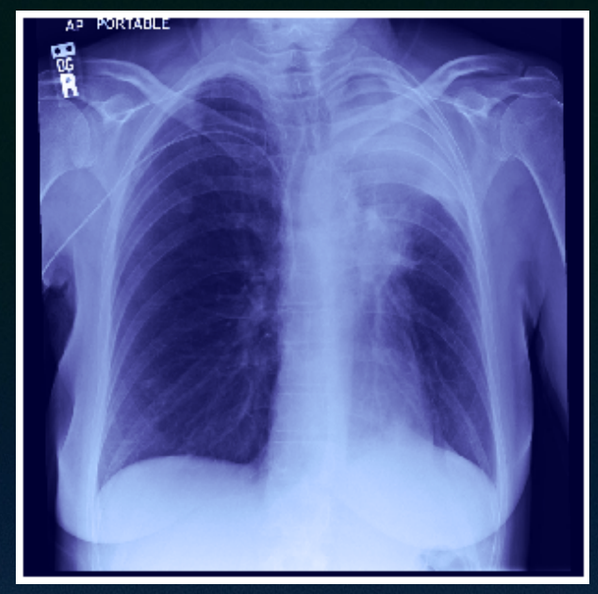
- Opacity across dataset

CNN Filter



- What the model “sees”

Results



- Binary Classification
- Two classes: Opacity, No Opacity
- %77 accuracy validation set
- Cut point for “opacity” classification can be reset so that providers can rule out pneumonia with high sensitivity.

Conclusions

- Data Science can successfully augment providers' clinical judgement to aid diagnosis

- Convolutional Neural Nets:
  proven and continue to be a useful tool - images

- Pneumonia-specific diagnosis algorithm
  feasible, with additional clinical information

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References

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- https://www.kaggle.com/c/rsna-pneumonia-detection-challenge
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