



Summer 2020 | Capstone Project | Final Presentation

Meet The Team

We are the people you can count on



Curtis Lin

A magician-like
“Lego Builder”

Data Scientist
Data Engineer



Chloe Wu

A goal-oriented
“Transformer”

Data Scientist
UI & DB Developer



Doug Xu

A trustworthy
“Brain Master”

Data Scientist
Model Developer



Justin Wu

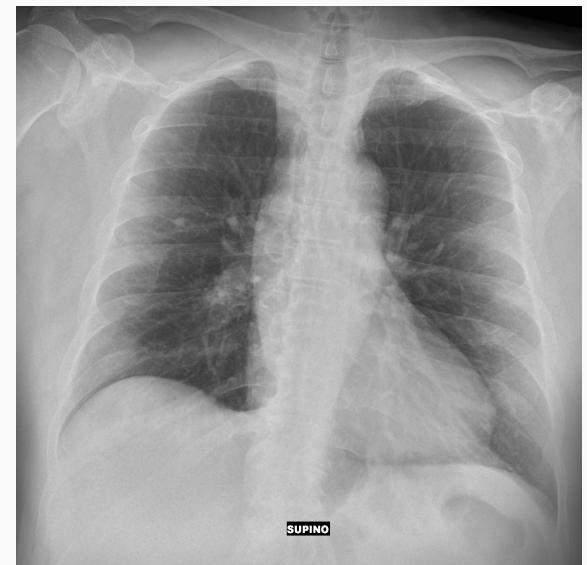
A versatile
“Idea Machine”

Data Scientist
Model Developer

Becoming An Expert Is Hard

In US, a radiologist needs to complete

13+ years of training &
continuing education throughout



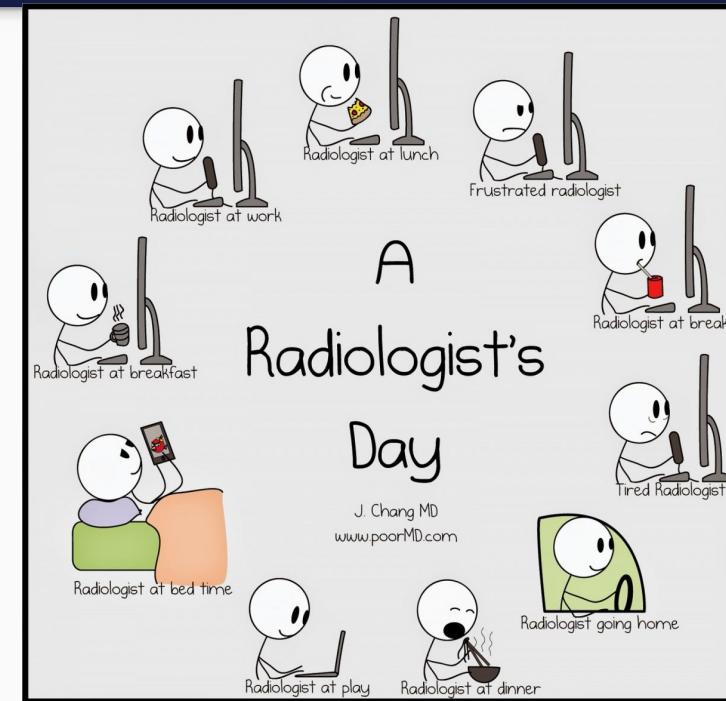
Shortage of Professionals

In US, there are only approximately

1
radiologist

—
10,000
population

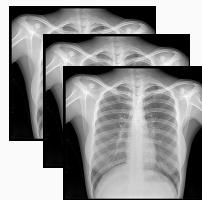
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Multiple Moving Parts



Medical data server



Talking to Physicians



Image storage server



Tired Radiologist



Patient Interviews

We Want to Help

Training takes time

Each radiologist needs to go through rigorous training to become one.



Radiologist shortage

It's an urgent issue globally, especially in developing countries.



Disjoint workflow

Radiologist needs to go to multiple places to get information needed for diagnosis.



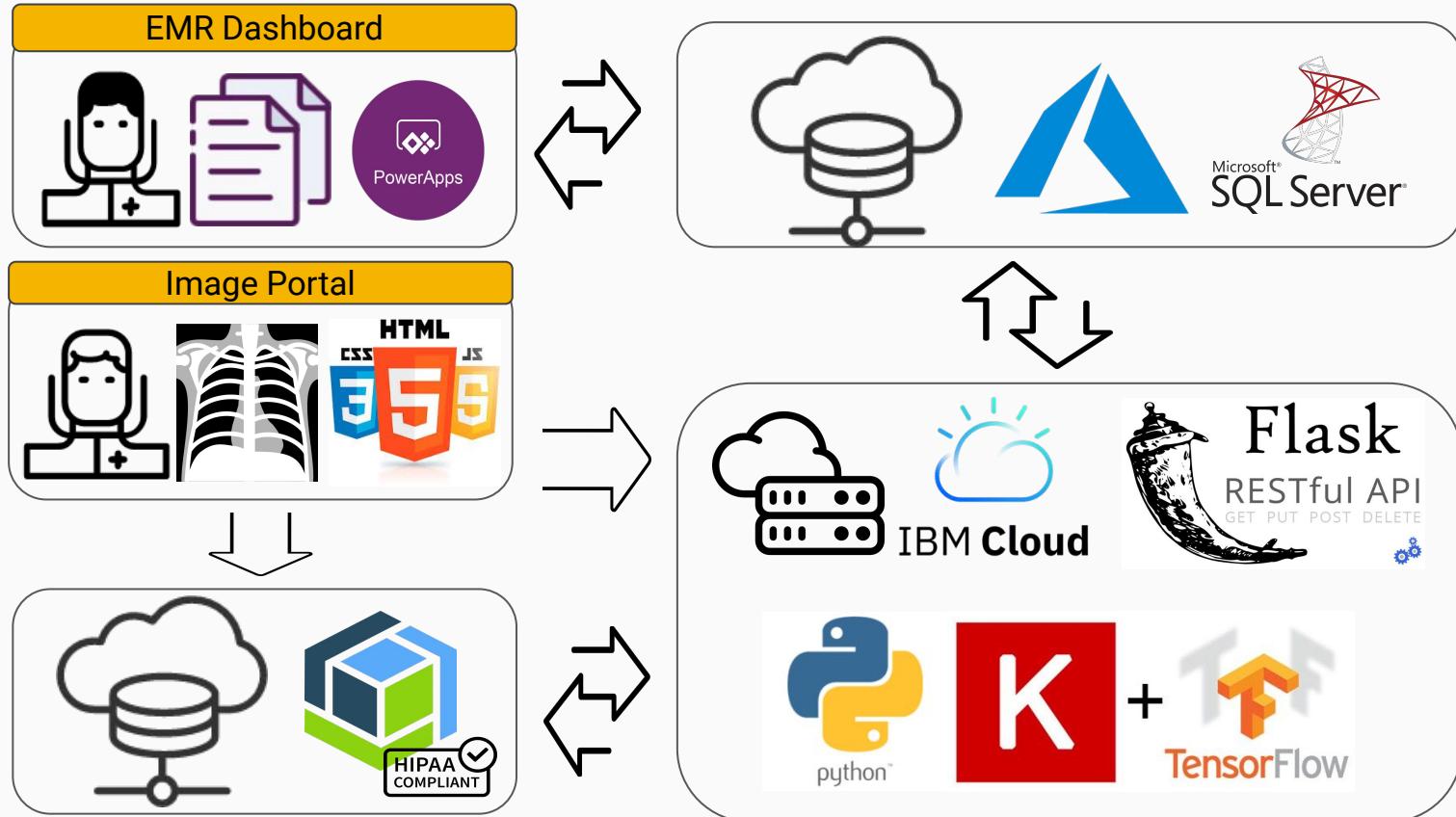
Offer AI Recommendations to Improve Diagnosis Efficiency

Integrate with Patient Medical Data

What is ChestX.ai?

An integrated **EMR Dashboard & Deep Learning** platform to empower radiologists.

Platform Architecture



Solution Demo



Image Upload Portal

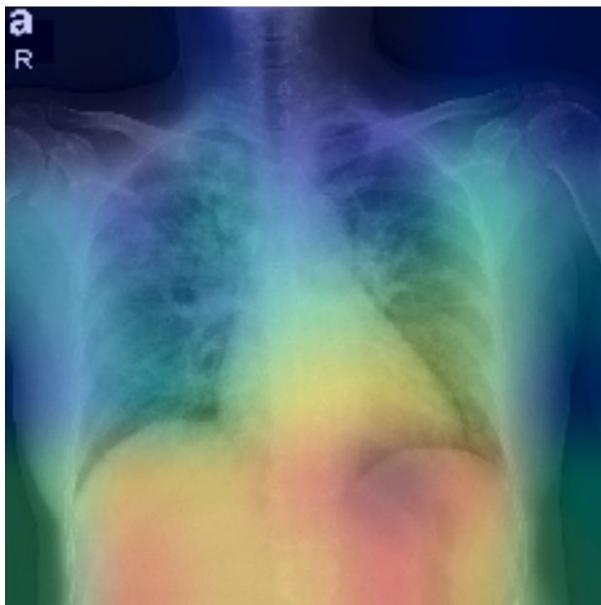


EMR Dashboard for
Radiologist

Different Prediction Outputs - Disease **with** COVID-19

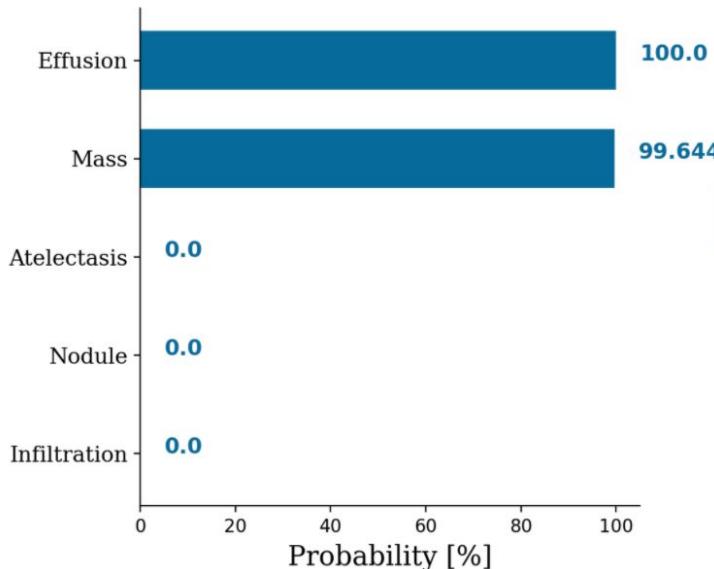
Image Summary

Highlighted Area Indicative of Predicted Diseases



Diagnosis

Probability Ranking of Predicted Diseases



AI Recommendations

COVID-19 Infection Alert

AI detected this patient to be potentially COVID-19 infected.

Infection Probability

98.6%

*Disclaimer: Infection probability is entirely based on patient's chest X-Ray image. To confirm COVID-19 infection, additional test may be needed.

Different Prediction Outputs - Disease **without** COVID-19



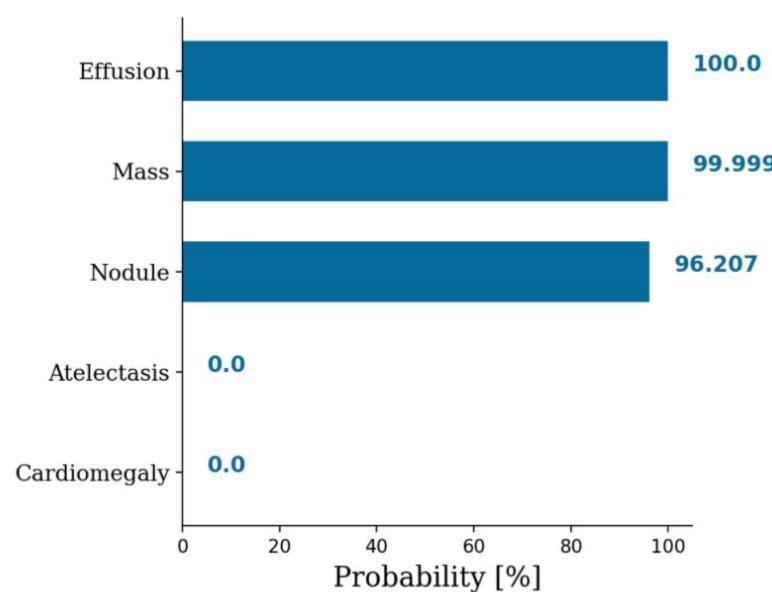
Image Summary

Highlighted Area Indicative of Predicted Diseases



Diagnosis

Probability Ranking of Predicted Diseases



AI Recommendations

Different Prediction Outputs - No Finding



Image Summary

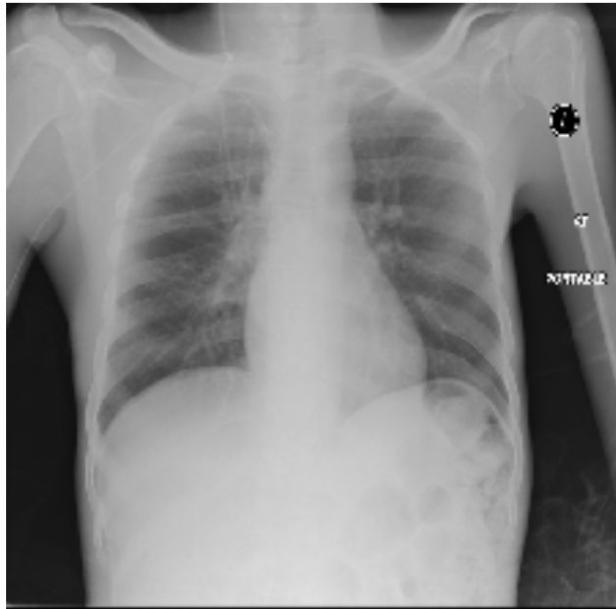


Diagnosis

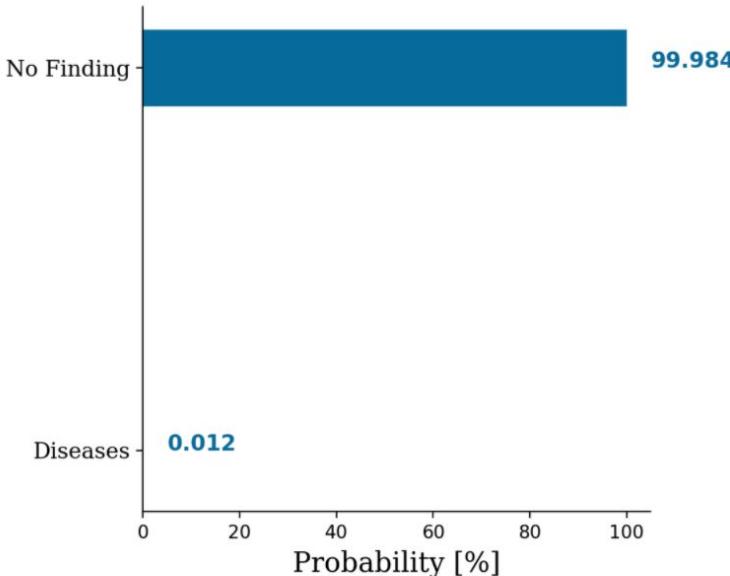


AI Recommendations

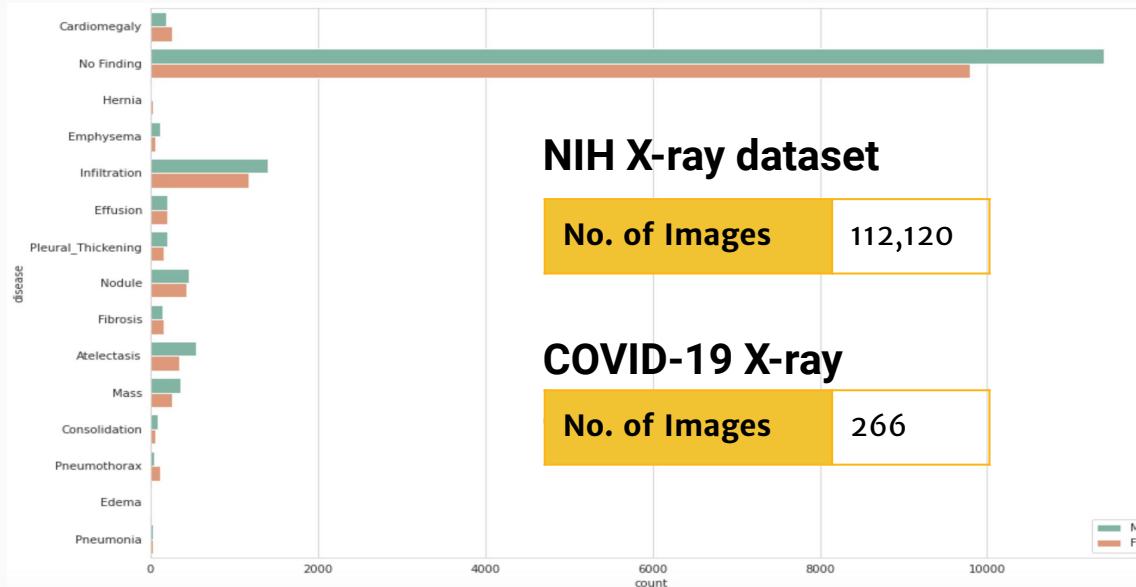
There is no abnormality found in the image area.



Probability of No Finding vs. Diseases



Data Imbalance & Noise



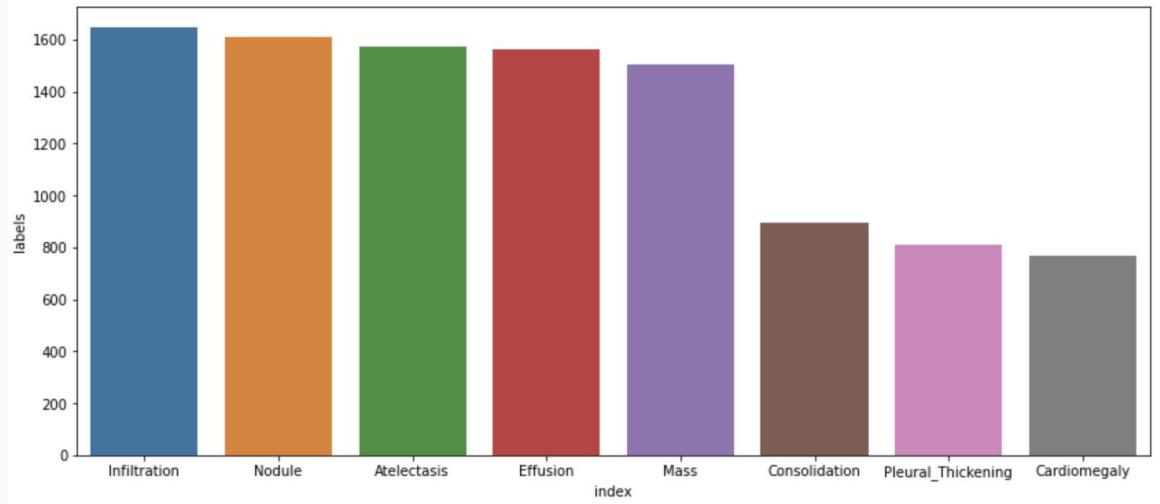
COVID-19 X-ray

No. of Images 266

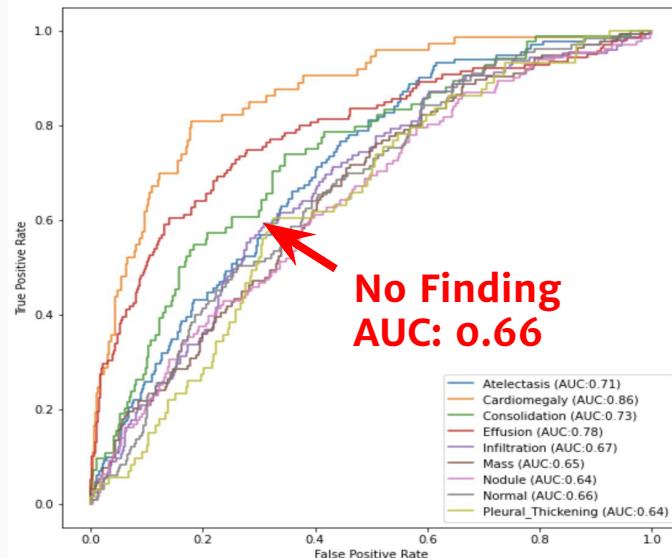


Data Solution

1. Rebalance image classes
2. Keep only images with age [20,70]



Poor “No Finding” Prediction



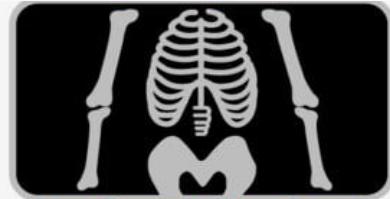
2-Tier Solution

DenseNet-121

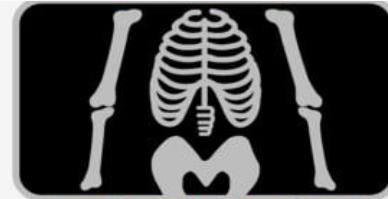
- **Binary:** No Finding vs. Disease
- Multi-Class Disease

Tier 1

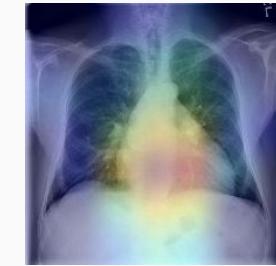
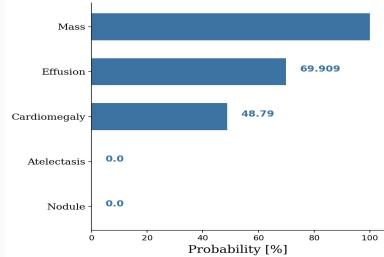
No Finding



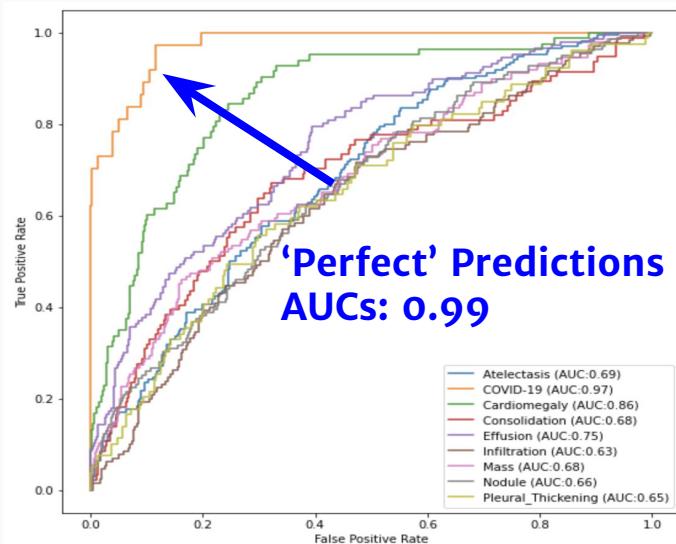
Disease



Tier 2



Too Perfect COVID-19 Prediction

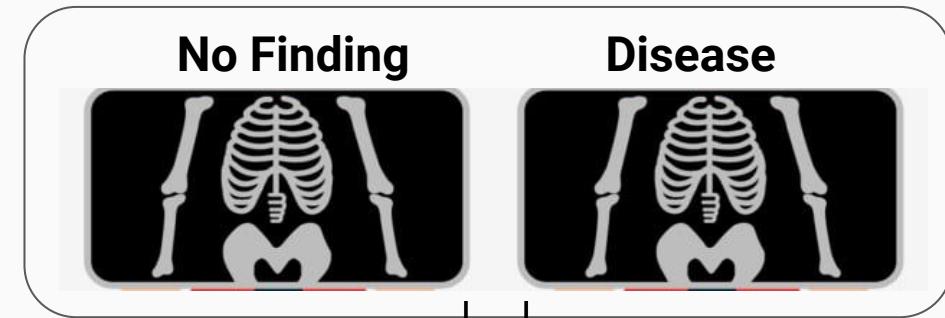


3-Tier Solution

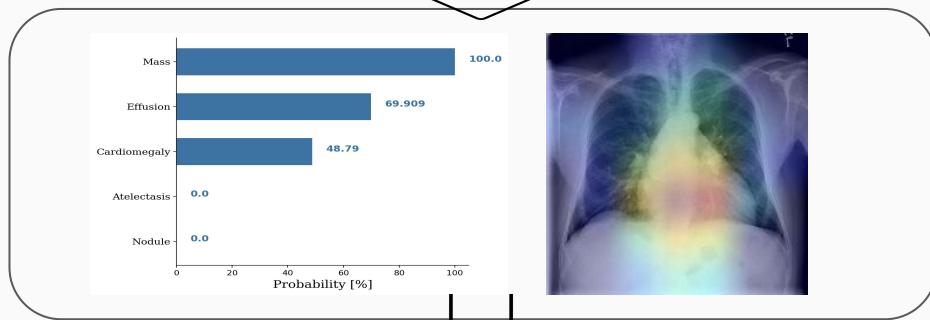
DenseNet-121

- Multi-Class Disease
- **Binary: COVID vs. non-COVID**

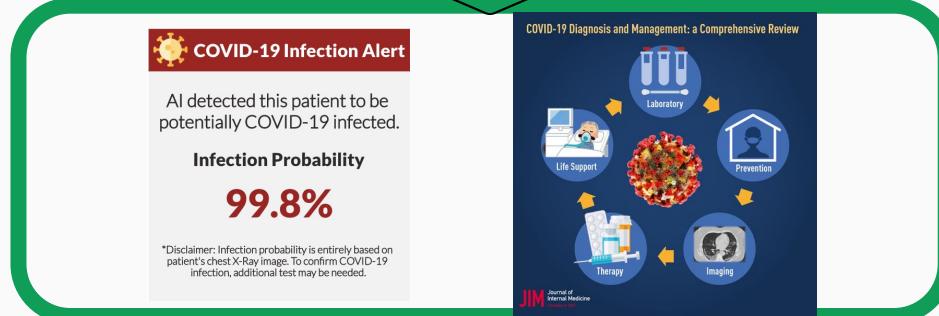
Tier 1



Tier 2



Tier 3

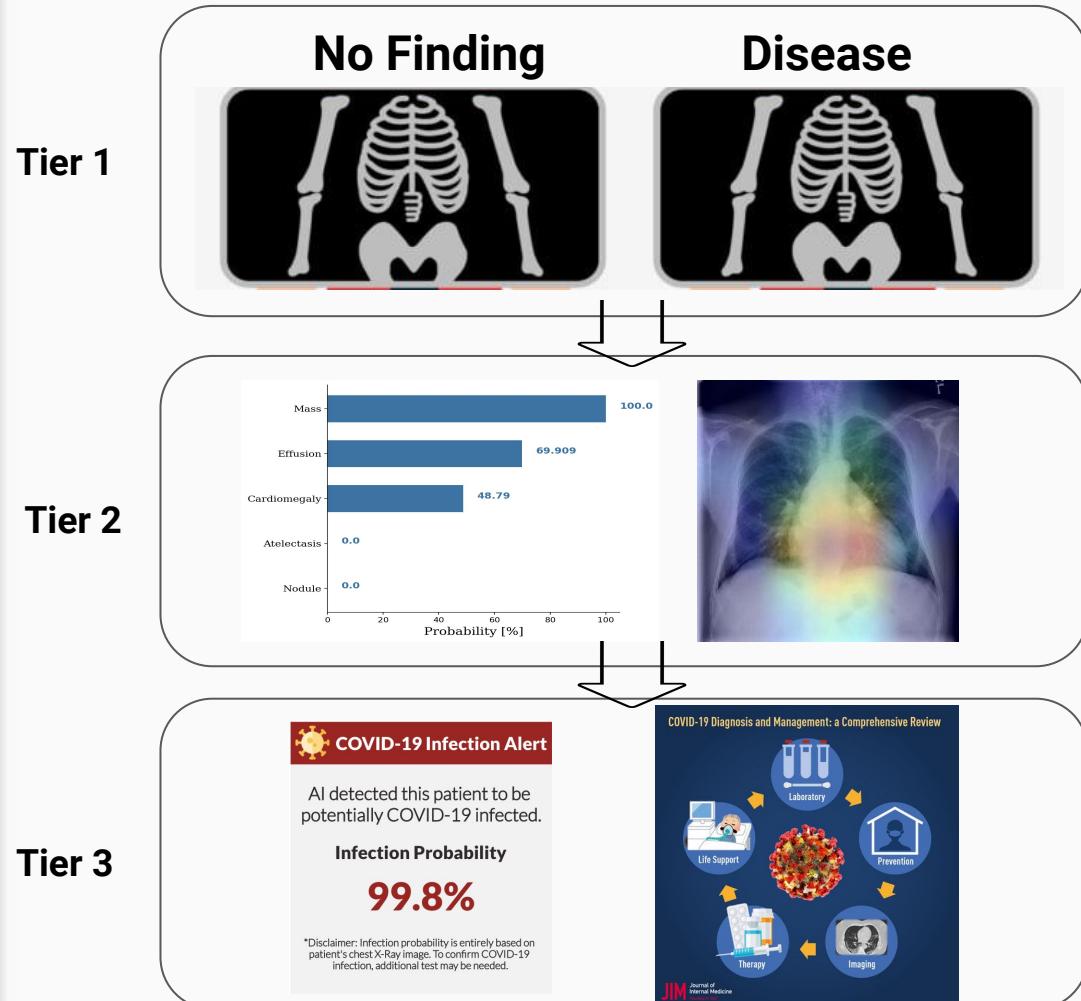


Final Approach

3-Tier Models

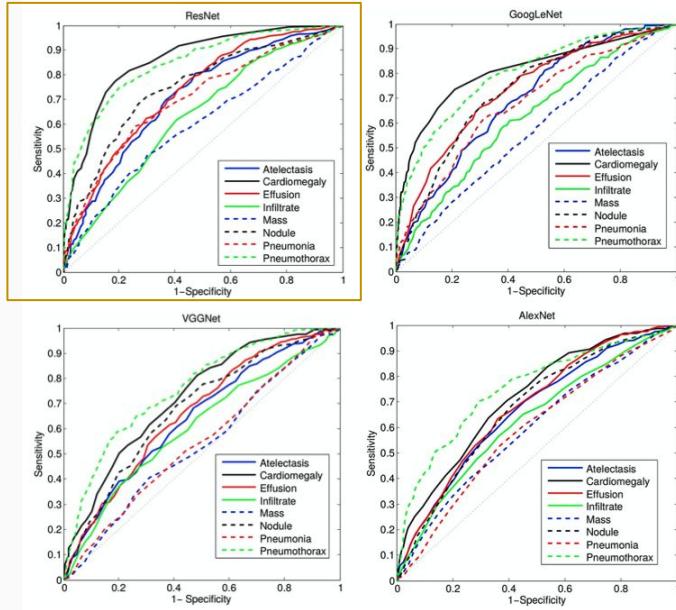
DenseNet-121

- Binary: No Finding vs. Disease
- Multi-Class Disease
- Binary: COVID vs. non-COVID



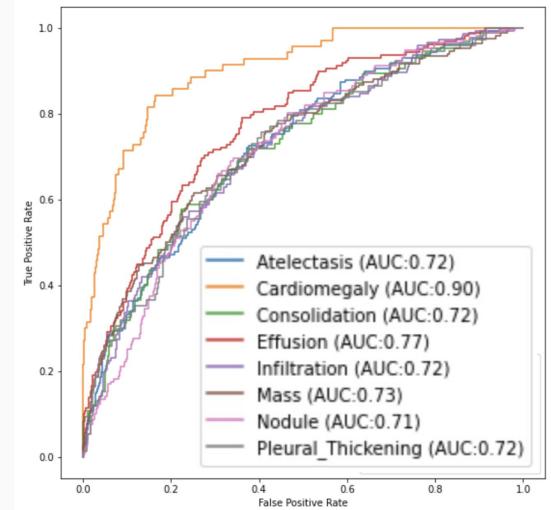
Competitive Performance

National Institutes of Health



ChestX.ai Performance

Pathology	NIH (best model)	ChestX.AI
Atelectasis	0.716	0.720
Cardiomegaly	0.807	0.900
Effusion	0.784	0.770
Infiltration	0.609	0.720
Mass	0.706	0.730
Nodule	0.671	0.710
Consolidation	0.708	0.720
Pleural Thickening	0.708	0.720
COVID-19	NA	0.9



Future Work

ChestX.ai MVP

Chest X-ray Disease Classification and EMR, X-ray, and AI Integration

Today

Hospital & Clinic Framework Integration

Customized integration solution based on the specific hospital or clinic medical database

Radiologist Partnerships

Garner domain knowledge during model training for performance optimization, and stakeholders' support

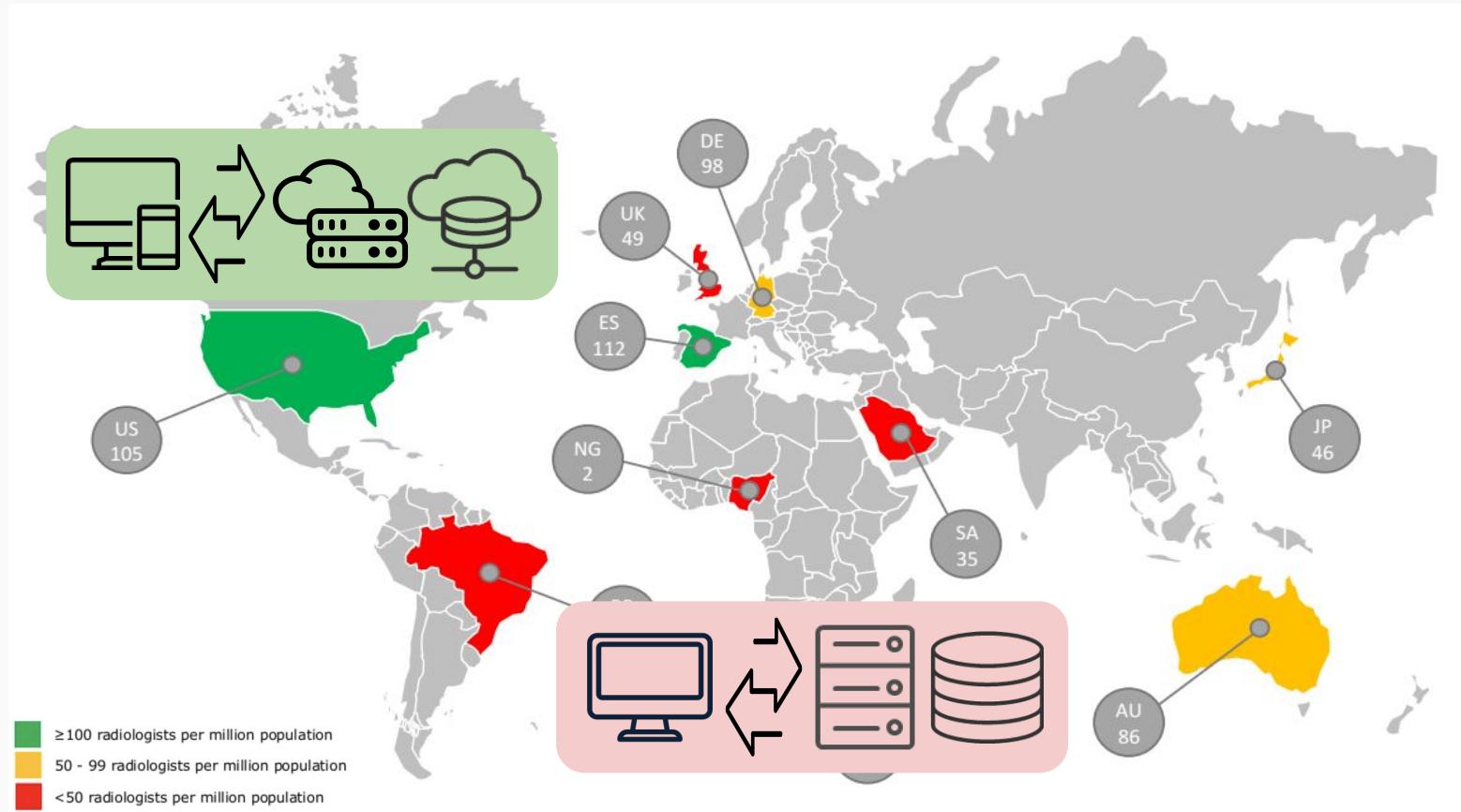
Data Refresh

Include more COVID-19 for modeling training. Existing labels can become more precise with segmentation

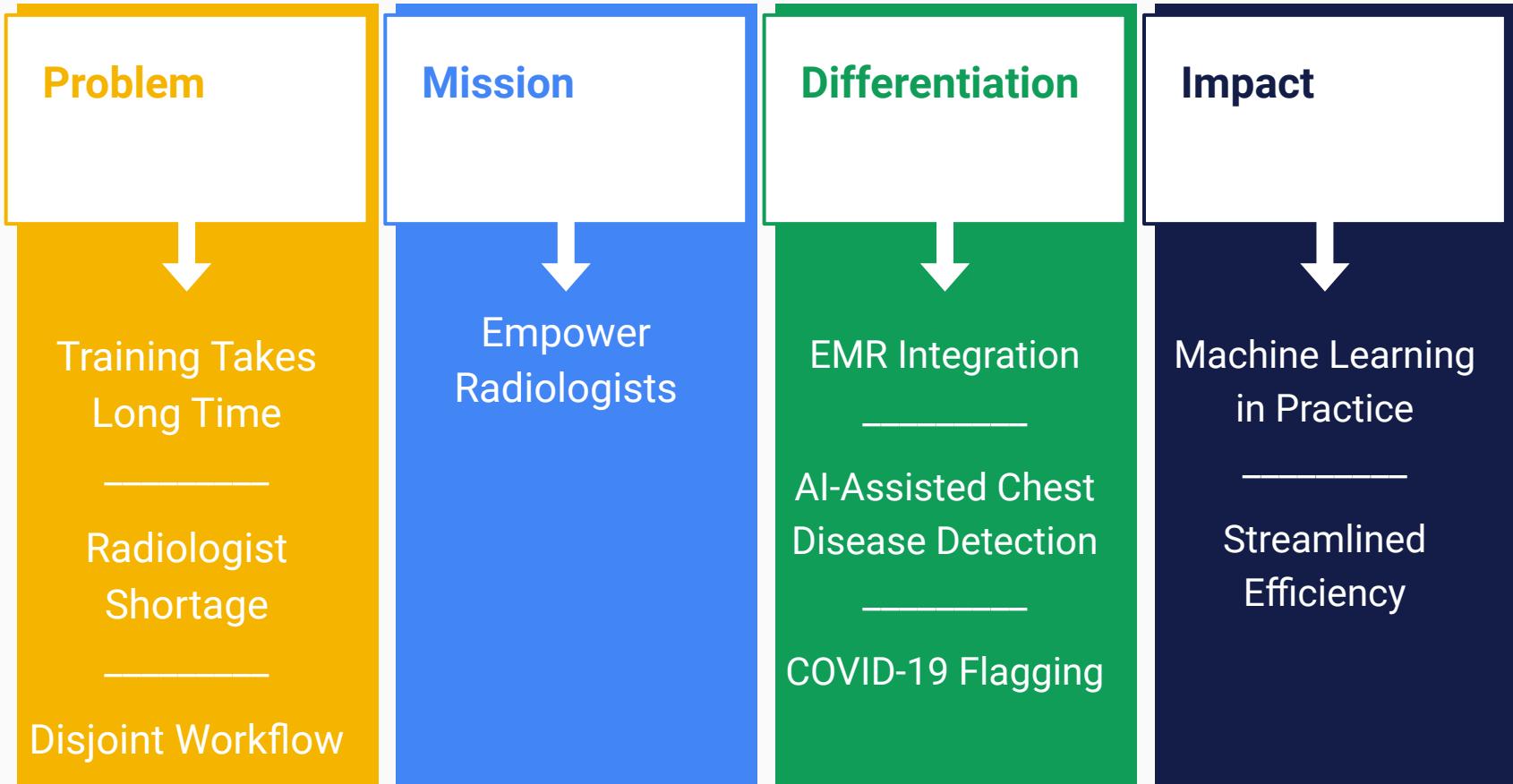
Medical Imaging Input Expansion

Modeling inputs can include CT, PET, and MRI scans. Additionally, imaging can expand towards other areas such as dental, knee and brain imaging.

Global Market Potential



Recap



CHESTX.AI

An integrated and intelligent system to
empower radiologists.

Contact Us

chestx.ai@gmail.com

References

1. <https://www.slideshare.net/SimonHarris36/5-reasons-why-radiology-needs-artificial-intelligence-68694372>
2. <https://www.acr.org/Practice-Management-Quality-Informatics/Practice-Toolkit/Patient-Resources/About-Radiology>
3. <https://stanfordmlgroup.github.io/projects/chexnet/>
4. <https://onlinelibrary.wiley.com/doi/10.1111/joim.1309>
5. https://openaccess.thecvf.com/content_cvpr_2017/papers/Wang_ChestX-ray8_Hospital-Scale_Chest_CVPR_2017_paper.pdf

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