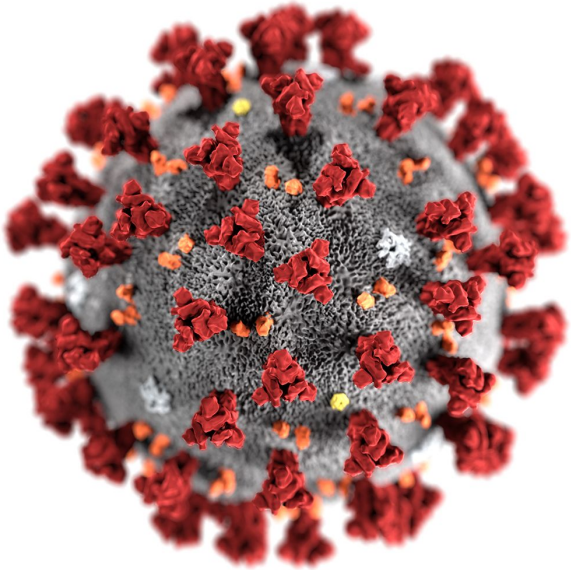
Deep Learning for COVID-19 Diagnoses using Chest Imaging



William Phu and Lawrence Wong

MOTIVATION AND BACKGROUND

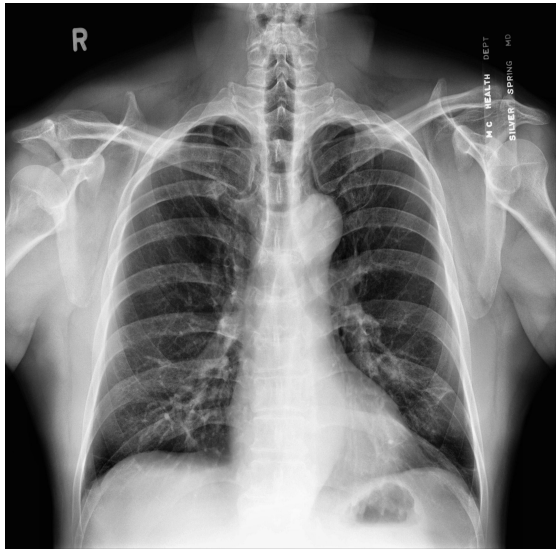
- Coronavirus, Pandemic, and Us

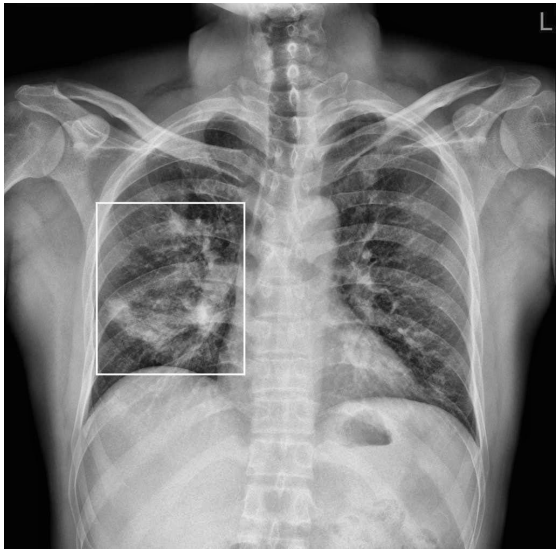
- Flawed tests, scarce supplies, limited access to screening

- Accurate tests are needed to slow transmission

Why should we use X-rays?

NORMAL





COVID19

- Commonly used to detect abnormalities in lung tissues
  - Targets of respiratory diseases
  - COVID-19, TB, viral and bacterial pneumonia
- Easy, fast, and widely accessible for hospitals

IMAGE PROCESSING

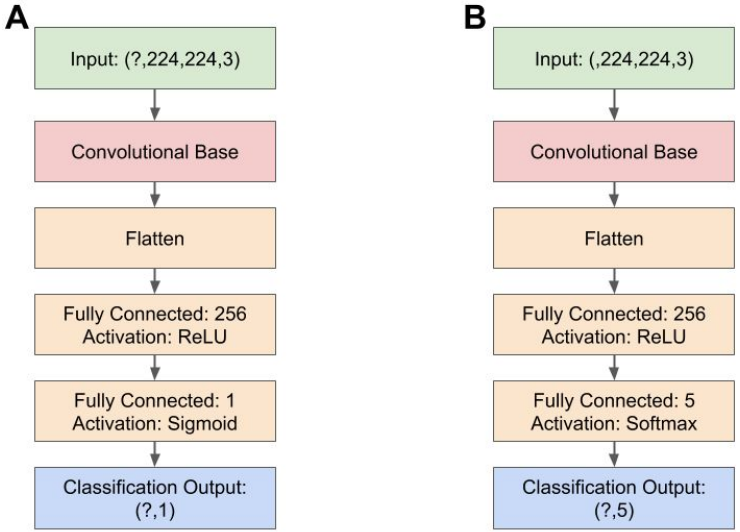
Original

CLAHE

ImageDataGenerator

MODELS

1. Logistic Regression
2. K-Nearest Neighbors
3. CNNs (ResNet, DenseNet, VGG)

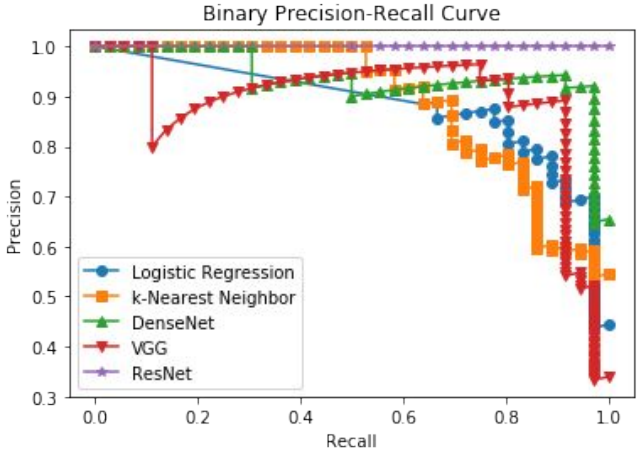


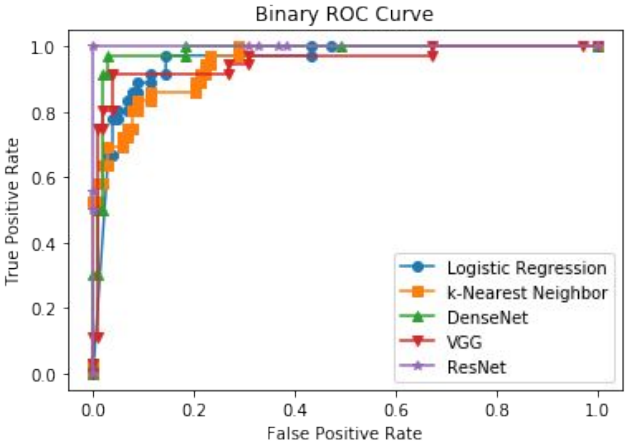
RESULTS

- Best Binary: ResNet with **0.99**
  CNN models achieved over 90% accuracy

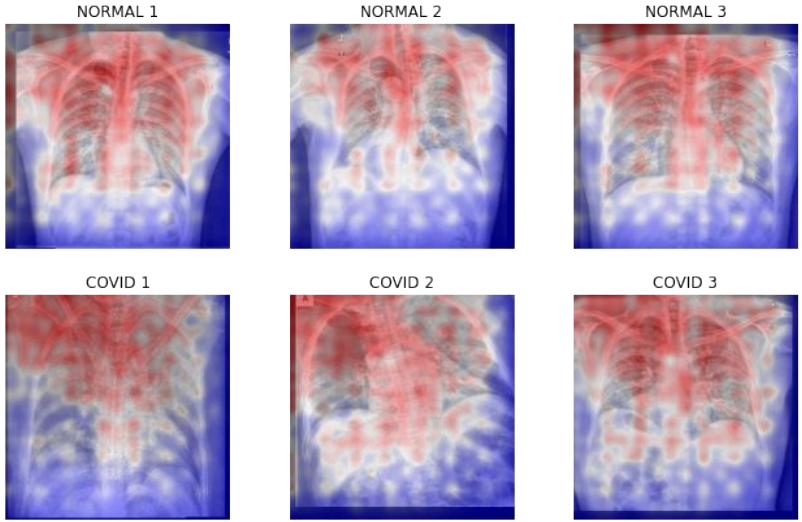
- Best Multi-class: ResNet with **0.77**
  CNN models performance suffered with an average accuracy of 70%

- More complex models and additional training is needed to improve results.

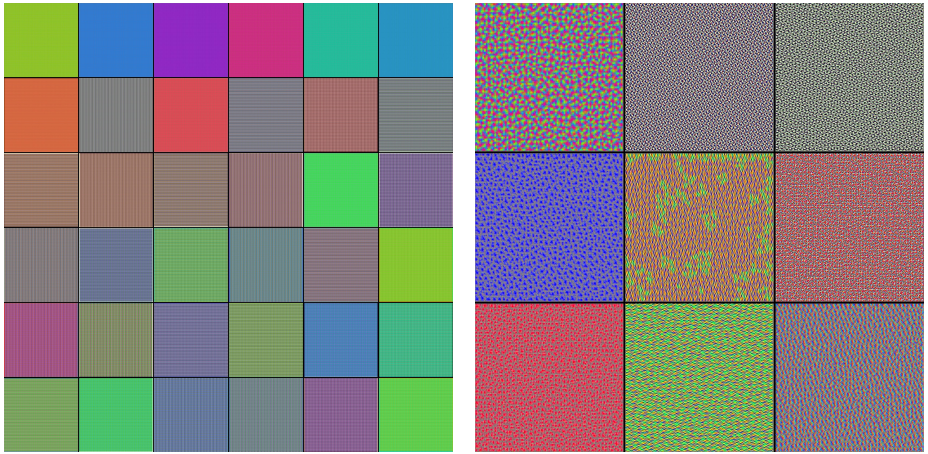




Is ResNet Actually Working!?



Saliency Map



Convolutional Layer Visualization

CONCLUSION

- Current CNN models are well suited for identifying patients who have respiratory illnesses.

- Have potential but suffer when identifying the specific illnesses
  - Deeper, more complex models may overcome this limitation

- Not a replacement but a tool to assist health-care professionals

Any Questions?

BINARY-CLASS MODEL RESULTS

Model	Accuracy	Precision	Sensitivity	Specificity	F1
Logistic Regression	0.86	0.76	0.81	0.91	0.89
KNN	0.87	0.69	0.92	0.86	0.88
DenseNet	0.97	0.90	0.97	0.96	0.96
VGG	0.93	0.89	0.89	0.96	0.94
ResNet	**0.99**	**1.00**	**0.97**	**1.00**	**0.99**

MULTI-CLASS MODEL RESULTS

Model	Accuracy	Precision	Recall	F1
Logistic Regression	0.58	0.58	0.58	0.58
KNN	0.62	0.63	0.62	0.62
DenseNet	0.71	0.69	0.69	0.69
VGG	0.70	0.70	0.69	0.71
ResNet	**0.77**	**0.76**	**0.73**	**0.74**