



# Covid CT Image Classification



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# Problem

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- Can we classify patients' CT scans into pathologies, without human intervention?
- Can we do this better than a radiologist?

"It's always hard to defend, but radiologists - we are human beings - and the inherent error rate of human being runs around .5 to 2% for everything we do in life... And o I like the example of a stroke that's missed on CT - it's hard to see - and then of course the MRI is done the next day and it's lighting up like a light bulb, right."

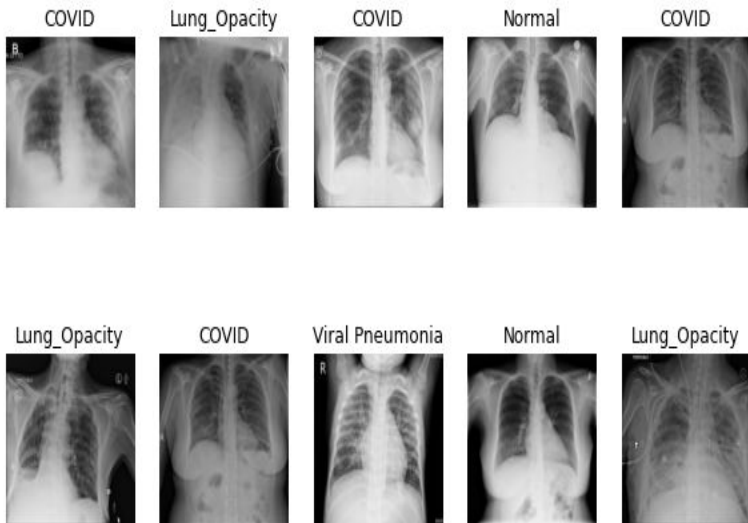
# Problem Landscape

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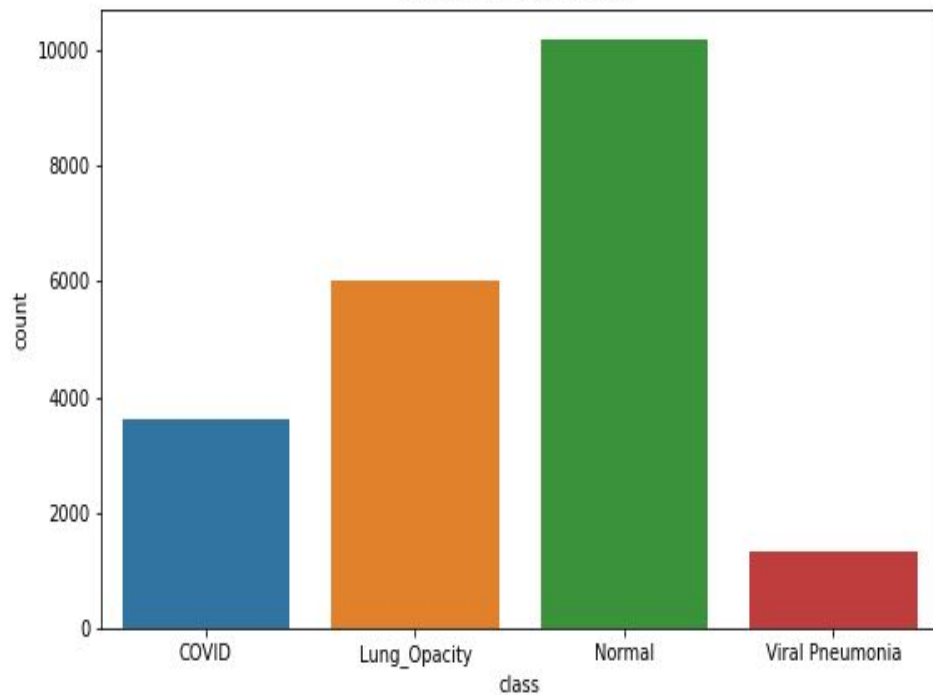
- Imagine is in high demand - there is no shortage of radiologists, but machine learning can improve diagnosis time, and in cases like breast cancer, catch calcium deposits or irregularities that a human can't possibly see.
- "It (*machine learning*) will be good. Everybody is racing... it's going to do the same thing to medicine that computers did for airline safety. It's going to make a huge difference in the accuracy that human error rate by 50% or more.
- "It's always hard to defend, but radiologists - we are human beings - and the inherent error rate of human being runs around .5 to 2% for everything we do in life... And o I like the example of a stroke that's missed on CT - it's hard to see - and then of course the MRI is done the next day and it's lighting up like a light bulb, right."

# Classes

Random Images



Distribution of Classes



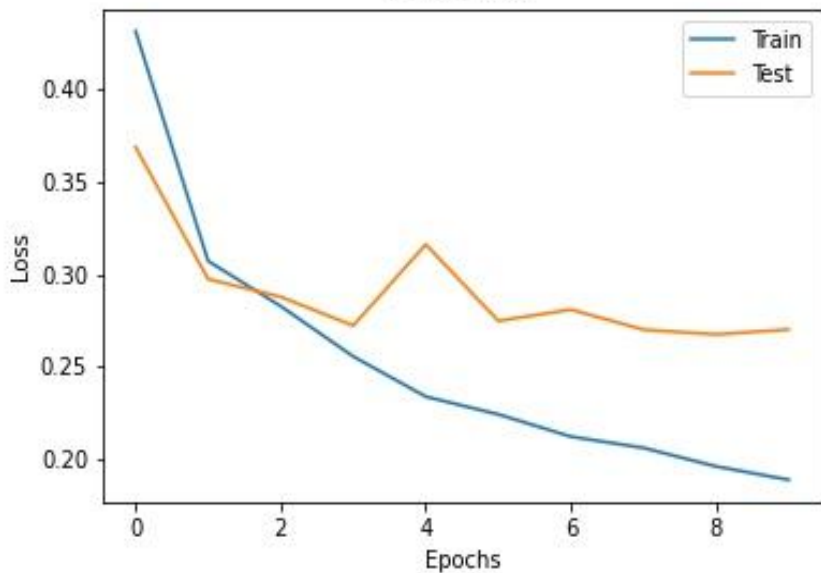
# Methodology

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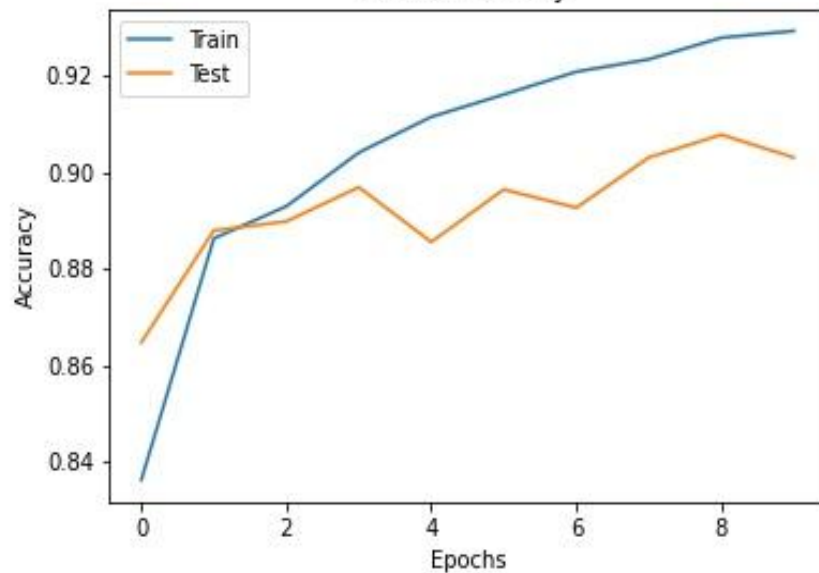
- Cleaning
  - Pytorch
- Model selection
  - TF
  - TF + transfer1 ( EfficientNetB0)
  - Pre-built Models (VGG16, Xception)
  - Pytorch + augmentation + pre-built (resnet18)
- Feature engineering
  - Shaping and augmenting the data
- Model designs

# TensorFlow Transfer Learning

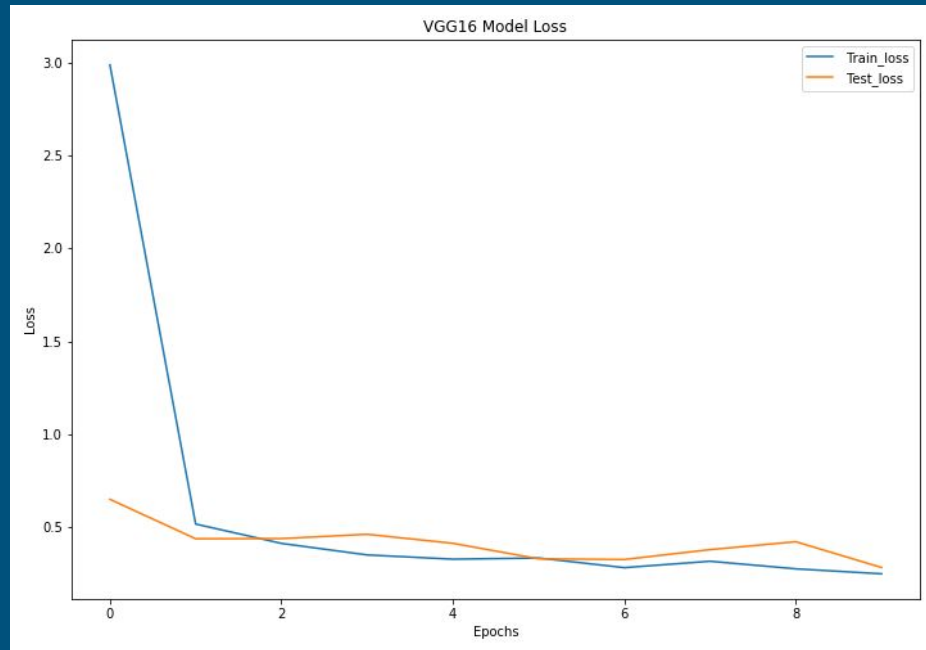
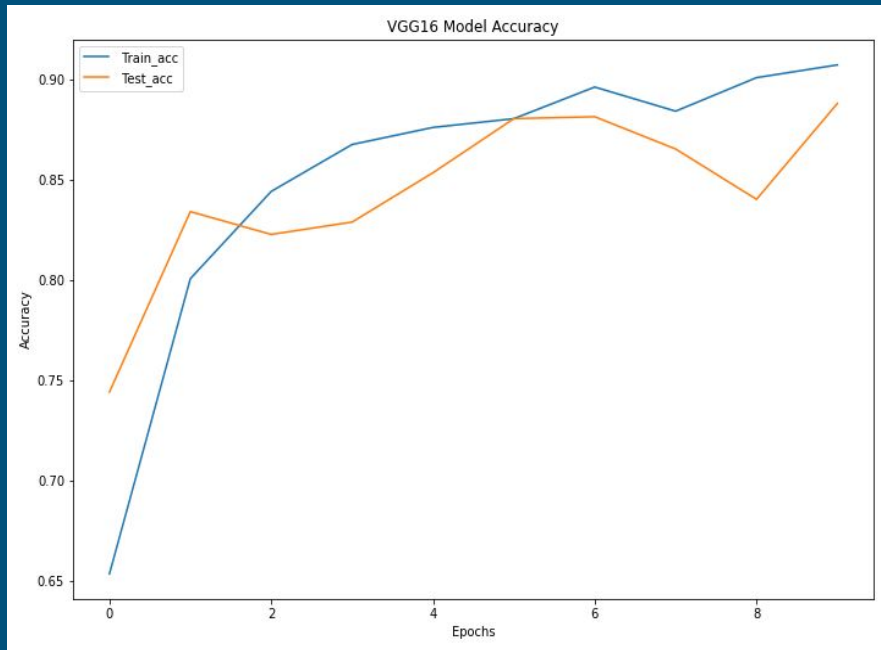
Model Loss



Model Accuracy



# Tensorflow VGG16

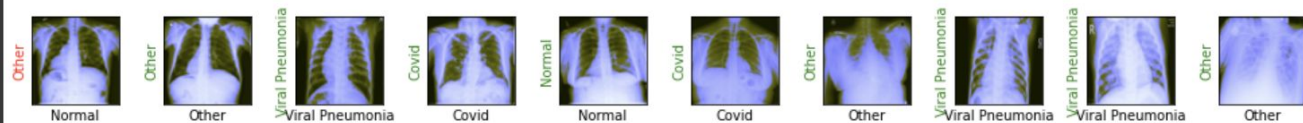


# Pytorch + Transfer Learning

- Class oriented (OOP)
- Augmentations

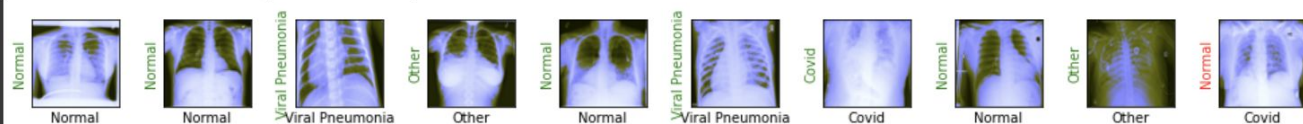
Evaluating at step 380

Validation Loss: 0.1049, Val Accuracy: 0.9679



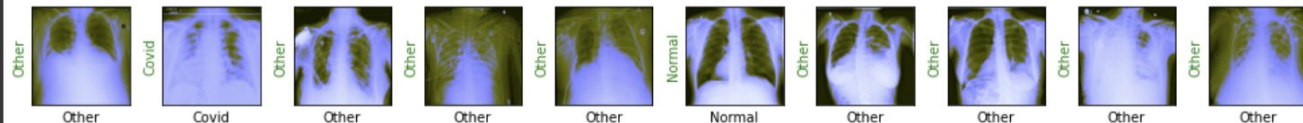
Evaluating at step 400

Validation Loss: 0.1509, Val Accuracy: 0.9466



Evaluating at step 420

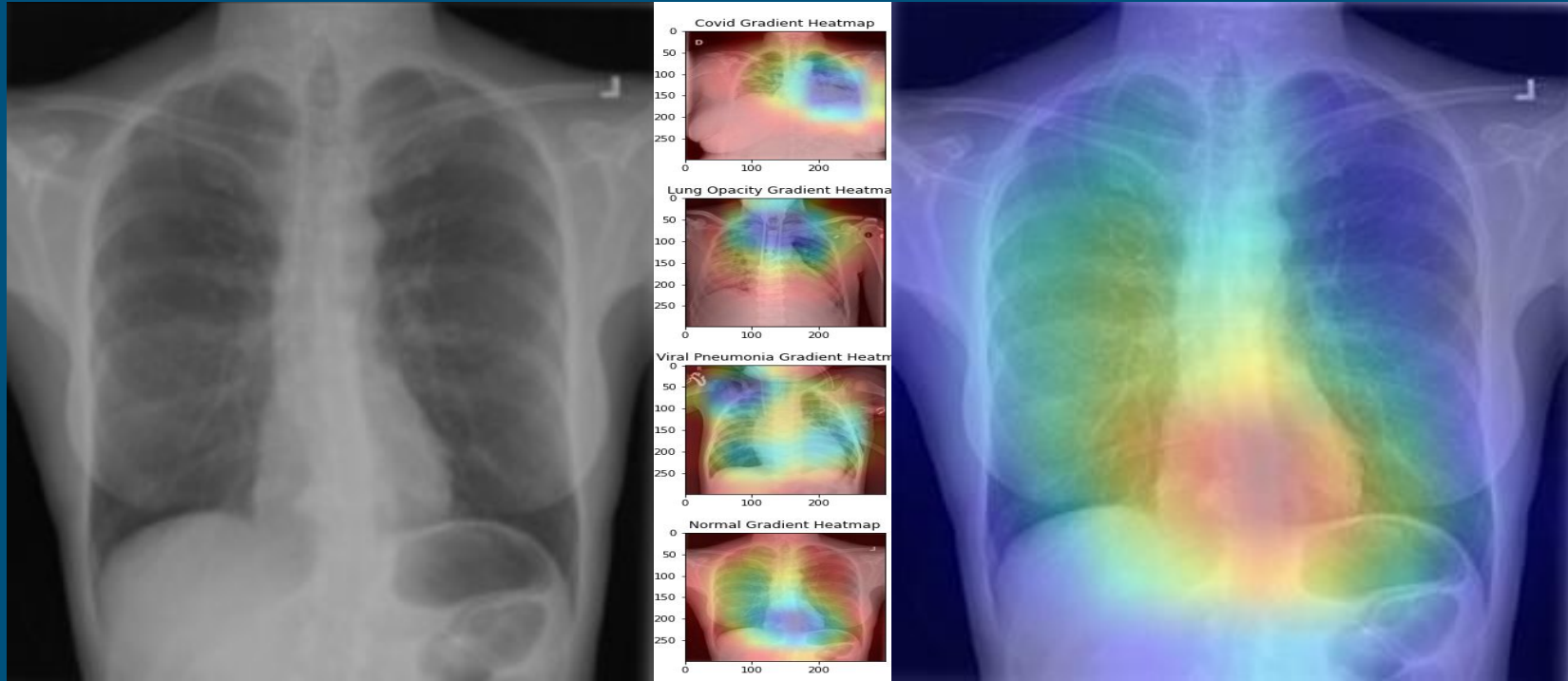
Validation Loss: 0.1045, Val Accuracy: 0.9669



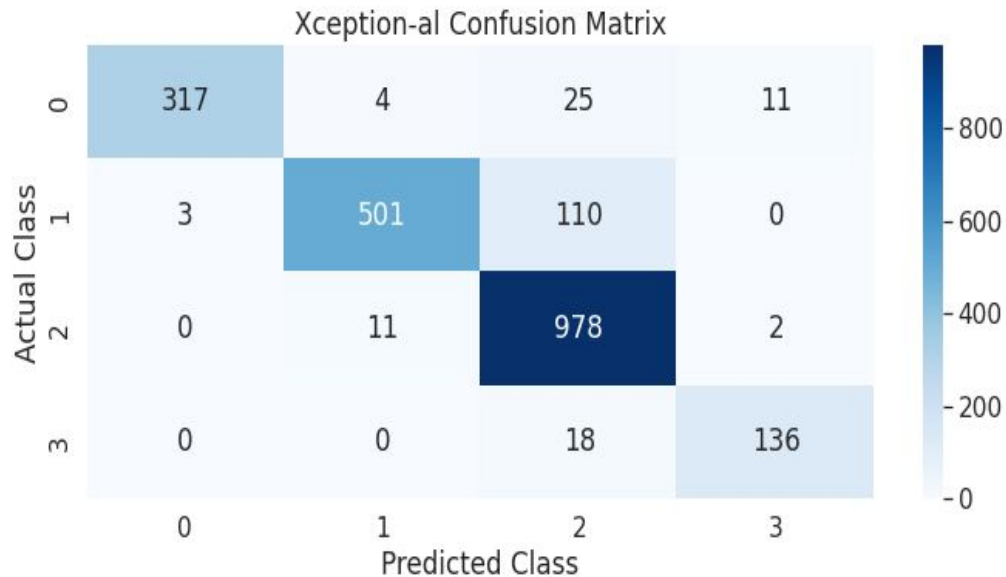


# Gradient Cam

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# Model reviews / tables 1



0: Covid  
1: Lung Opacity  
2: Normal  
3: Viral Pneumonia

	precision	recall	f1-score	support
0	0.99	0.89	0.94	357
1	0.97	0.82	0.89	614
2	0.86	0.99	0.92	991
3	0.91	0.88	0.90	154
accuracy			0.91	2116
macro avg	0.93	0.89	0.91	2116
weighted avg	0.92	0.91	0.91	2116

# Recommendations / next steps

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- Conclusions
  - Model improvement
  - “What would happen if we released this into the wild?”
  - Model tradeoffs (time vs. accuracy)
- Applications
  - Radiologist underpenetration
  - Radiologist productivity