Covid CT Image Classification

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Problem

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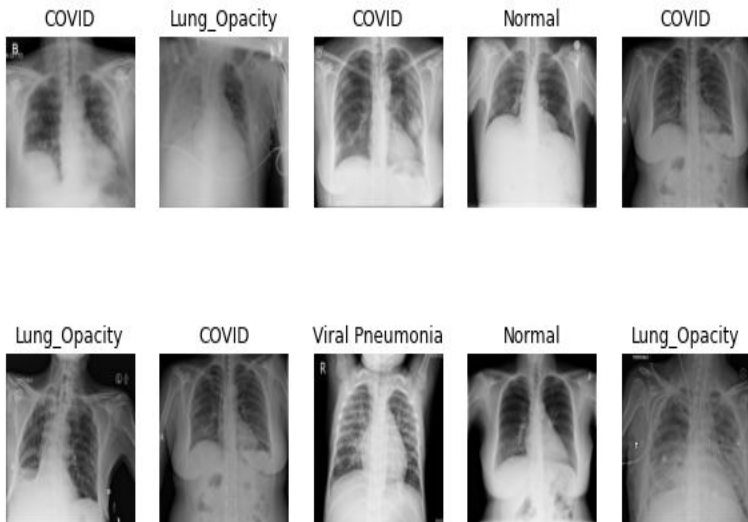
- Can we do this better than a radiologist?
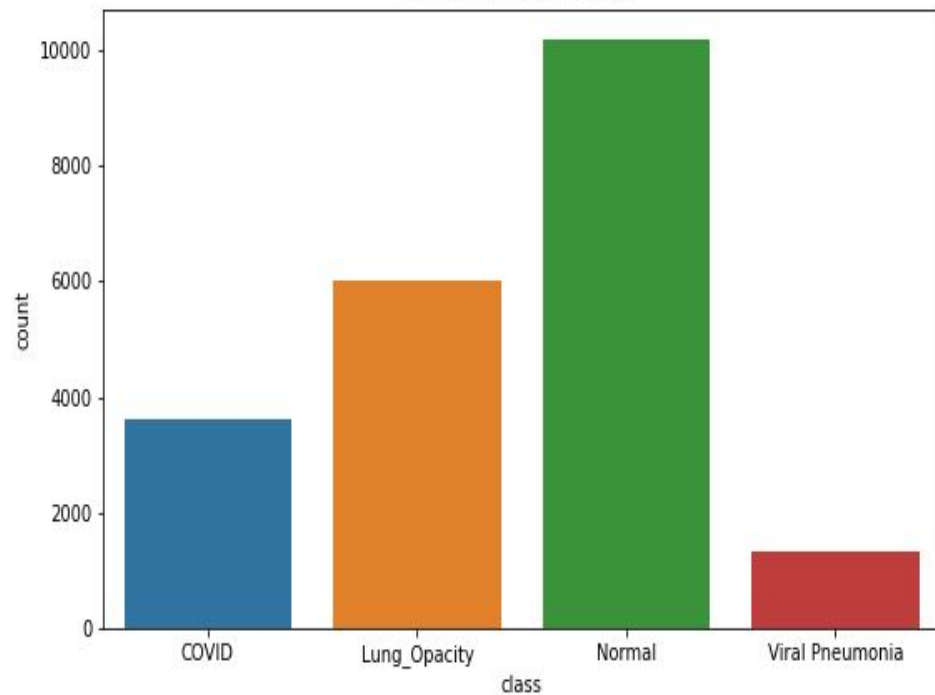
Problem Landscape

- 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

COVID, Lung_Opacity, COVID, Normal, COVID

Lung_Opacity, COVID, Viral Pneumonia, Normal, Lung_Opacity

Distribution of Classes
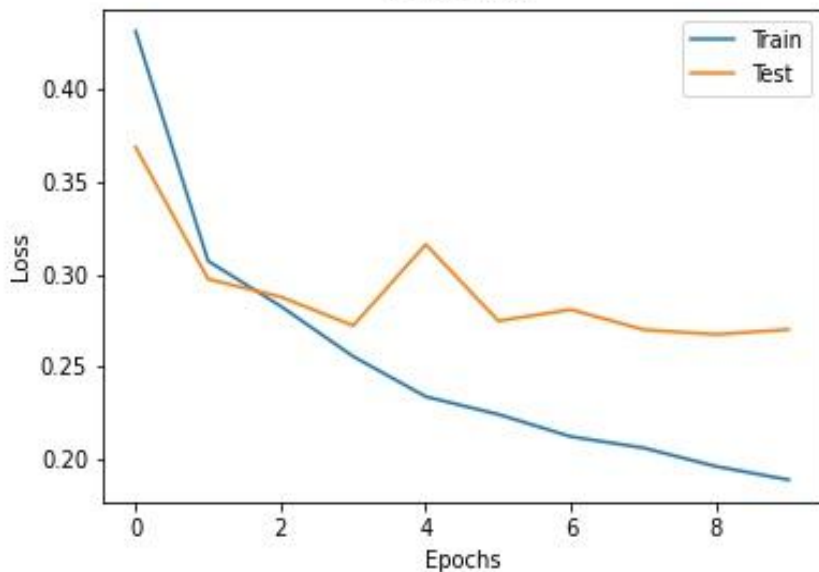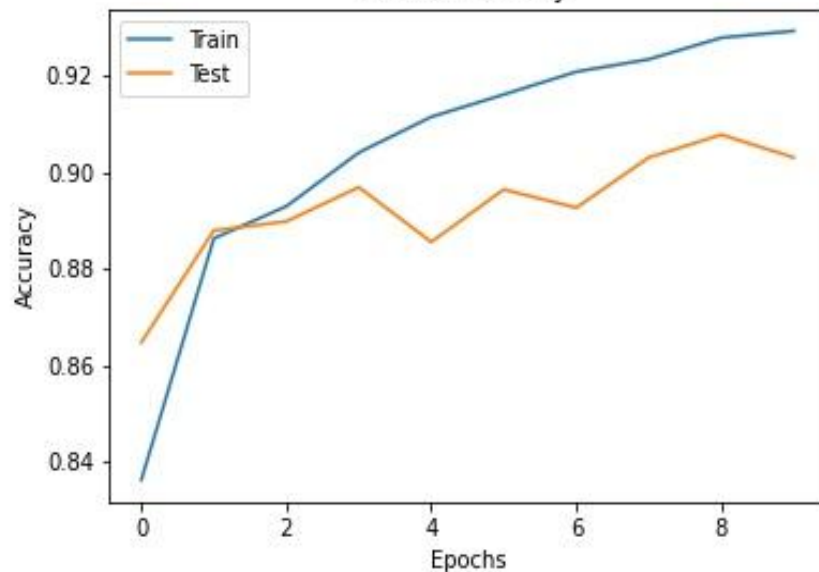
Methodology

- <u>Cleaning</u>
  - Pytorch
- <u>Model selection</u>
  - TF
  - TF + transfer1 (EfficientNetB0)
  - Pre-built Models (VGG16, Xception)
  - Pytorch + augmentation + pre-built (resnet18)

- <u>Feature engineering</u>
  - Shaping and augmenting the data

- <u>Model designs</u>
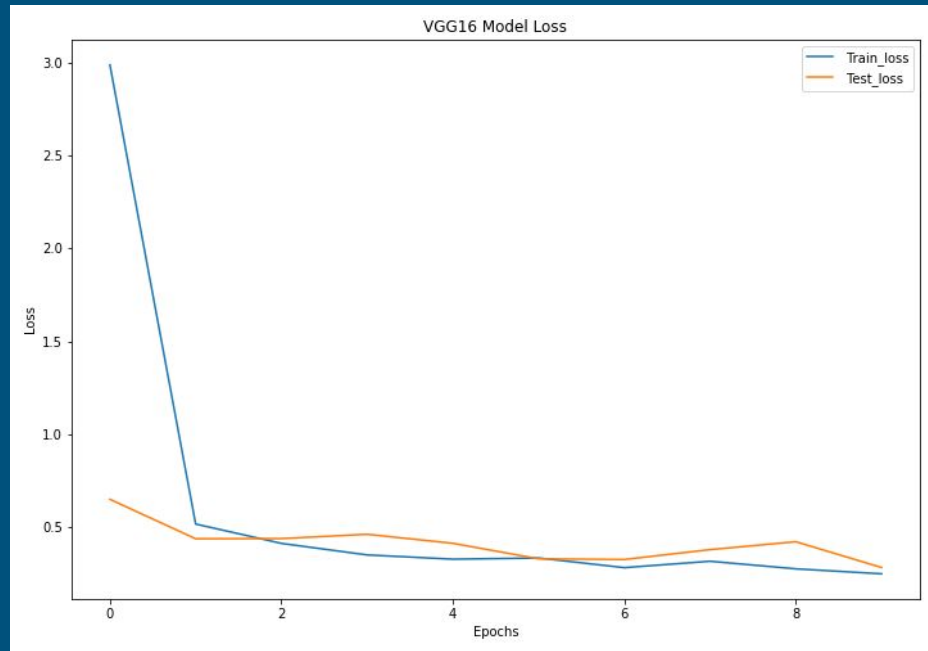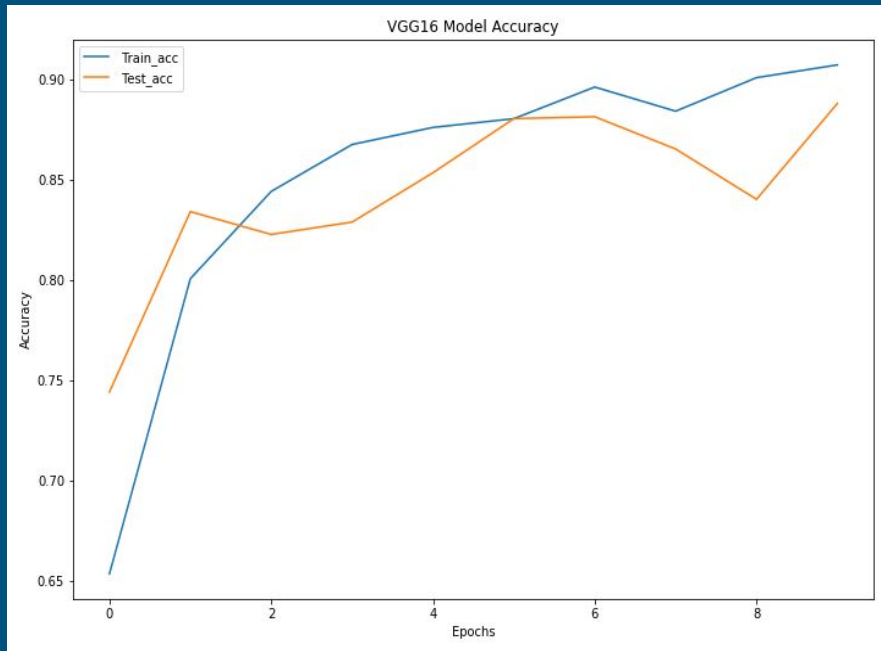
TensorFlow Transfer Learning

Tensorflow VGG16

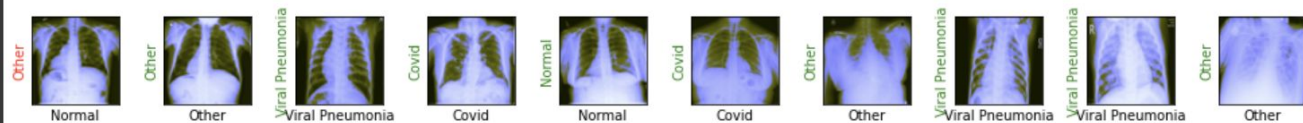# Pytorch + Transfer Learning

- Class oriented (OOP)
- Augmentations
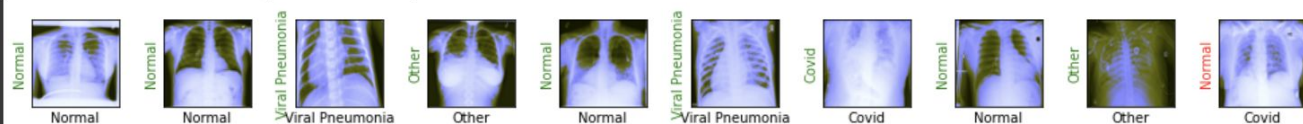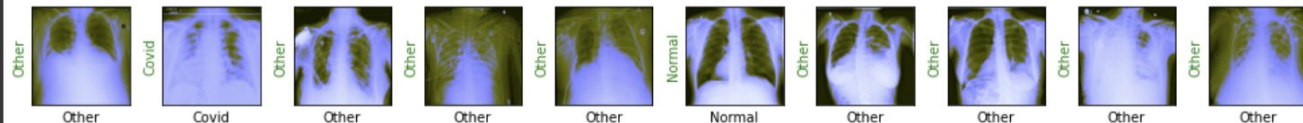
Gradient Cam

Model reviews / tables 1

Xception-al Confusion Matrix
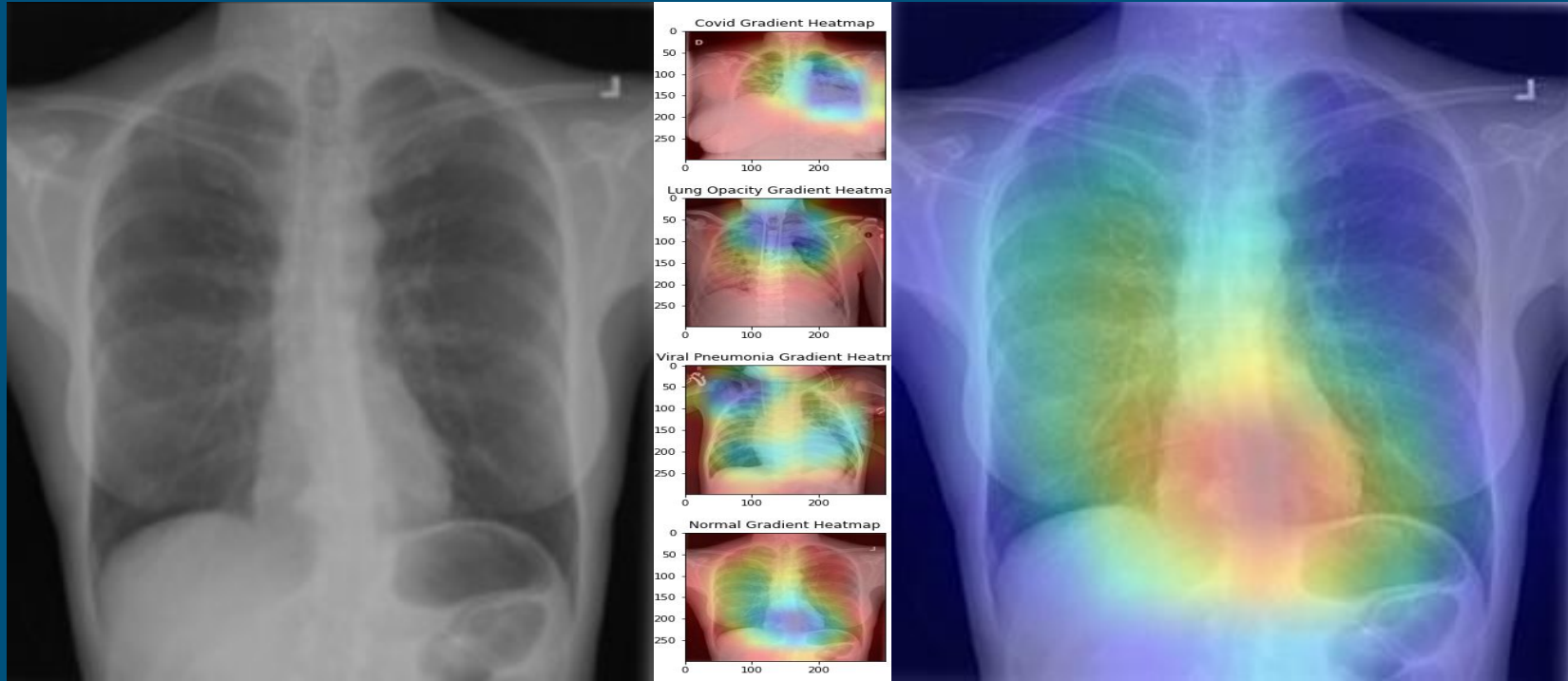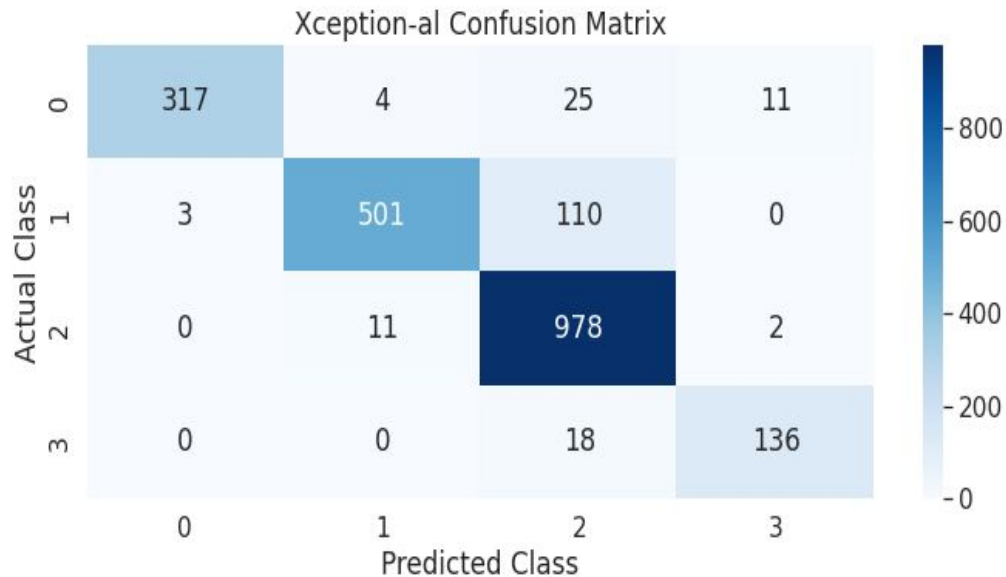
0: Covid
1: Lung Opacity
2:Normal
3:Viral Pneumonia

	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

- Conclusions
    - Model improvement
    - "What would happen if we released this into the wild?"
    - Model tradeoffs (time vs. accuracy)

- Applications
    - Radiologist underpenetration
    - Radiologist productivity