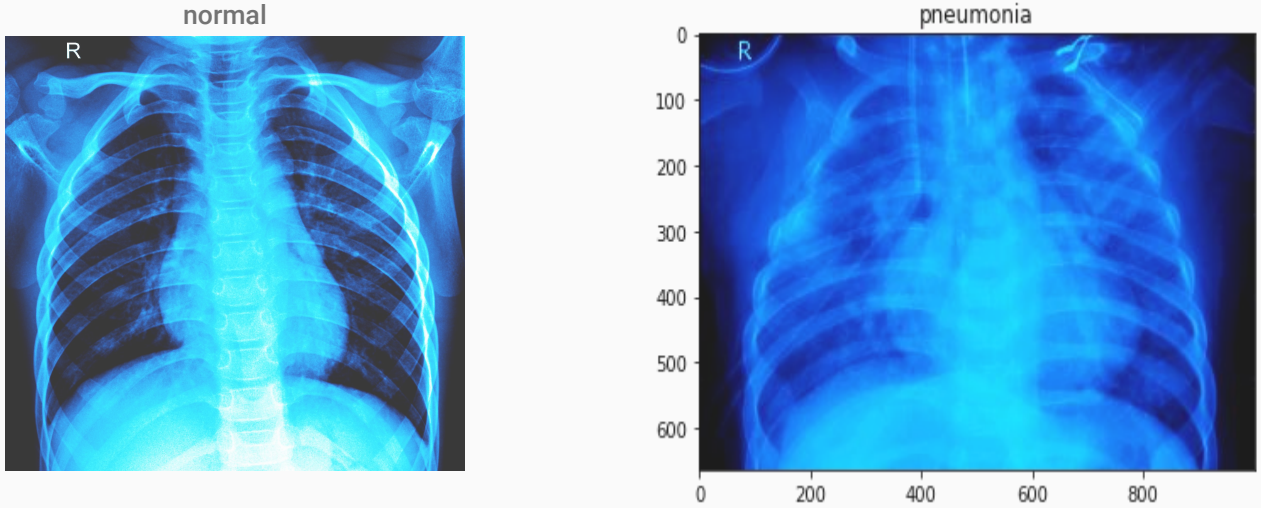
Chest X-Ray Images (Pneumonia) Classification

Machine Learning (ML) Modeling

Pneumonia can be life threatening



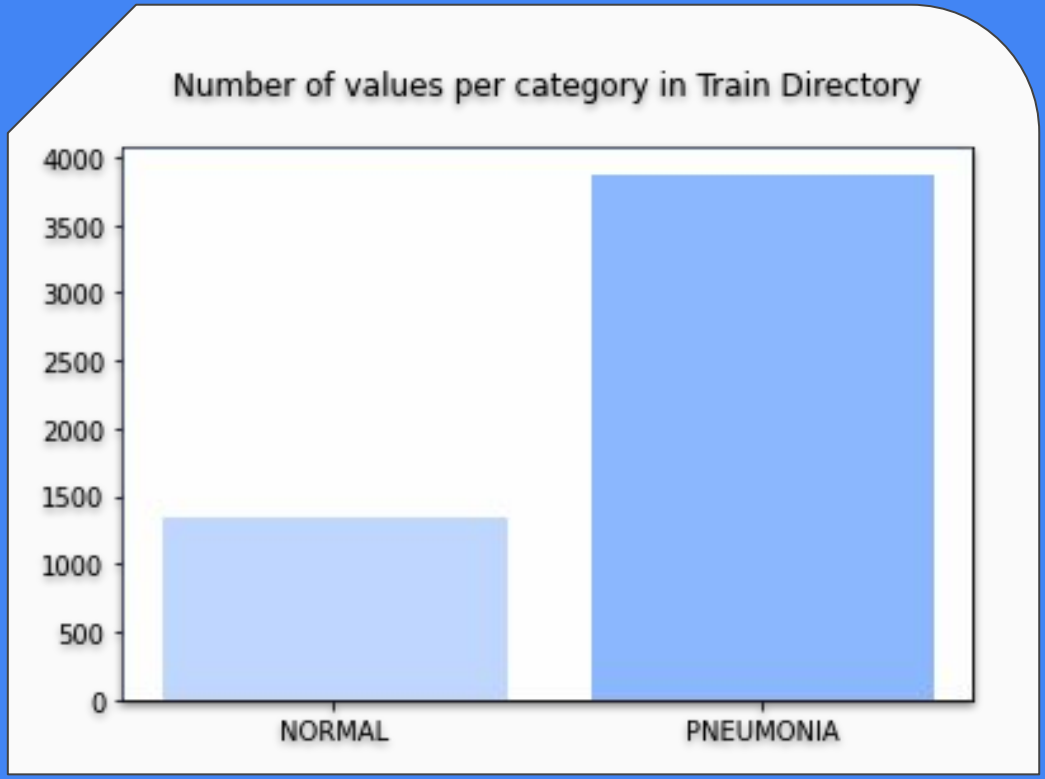
Chest X - ray image of patient with pneumonia

The Project

ML Algorithmic Advantages

- Eliminate manual measurements
- Prevent detection errors
- Lower patient and medical legal risk
- Reduce provider workflow

The Training Data

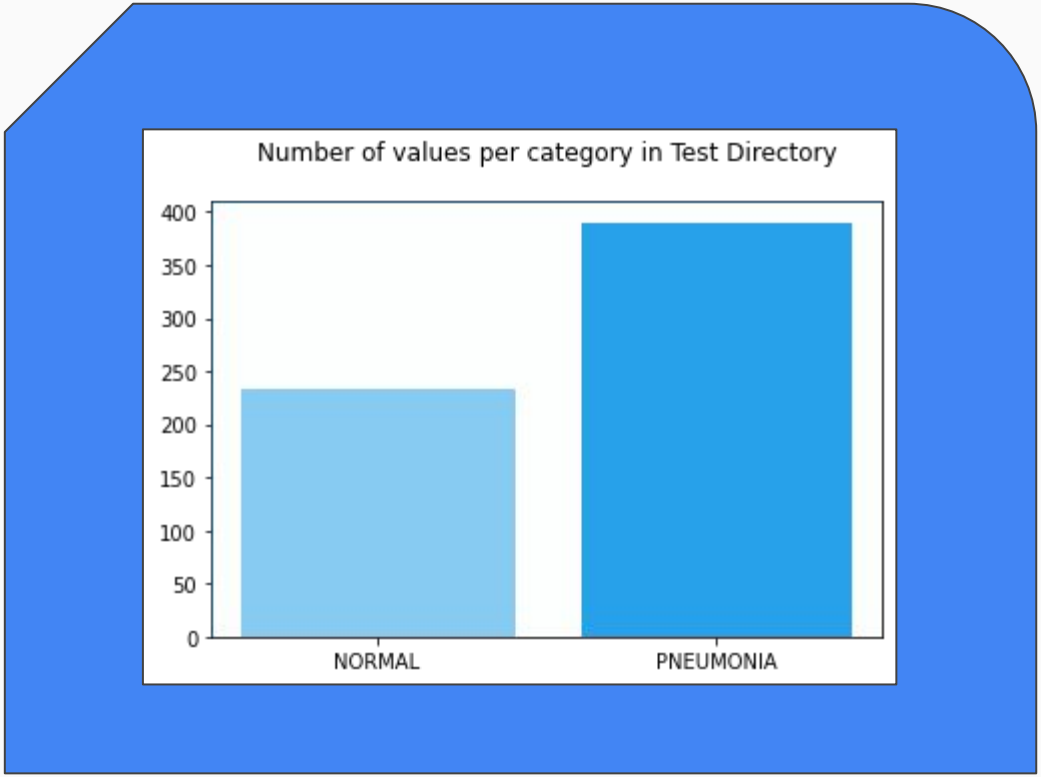


Test Data:

NORMAL: 234 (37.5%)

PNEUMONIA: 390 (62.5%)

Total images: 624



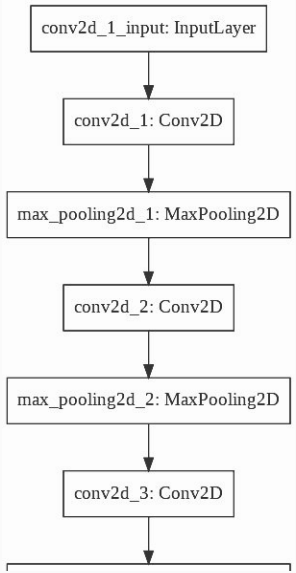
“Machine intelligence is the last invention that humanity will ever need to make.”

- Nick Bostrom, Swedish philosopher at the University of Oxford

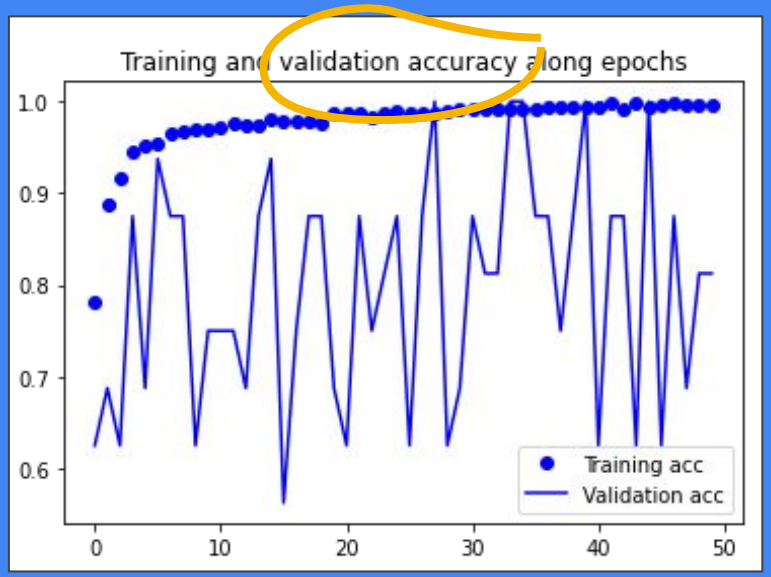
Model Architecture

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_1 (Conv2D)            (None, 148, 148, 32)      896
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 74, 74, 32)        0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 72, 72, 64)        18496
_________________________________________________________________
flatten_1 (Flatten)          (None, 331776)            0
_________________________________________________________________
dense_1 (Dense)              (None, 64)
21233728

dense_2 (Dense)              (None, 1)                 65
=================================================================
Total params: 21,253,185
Trainable params: 21,253,185
Non-trainable params: 0
```

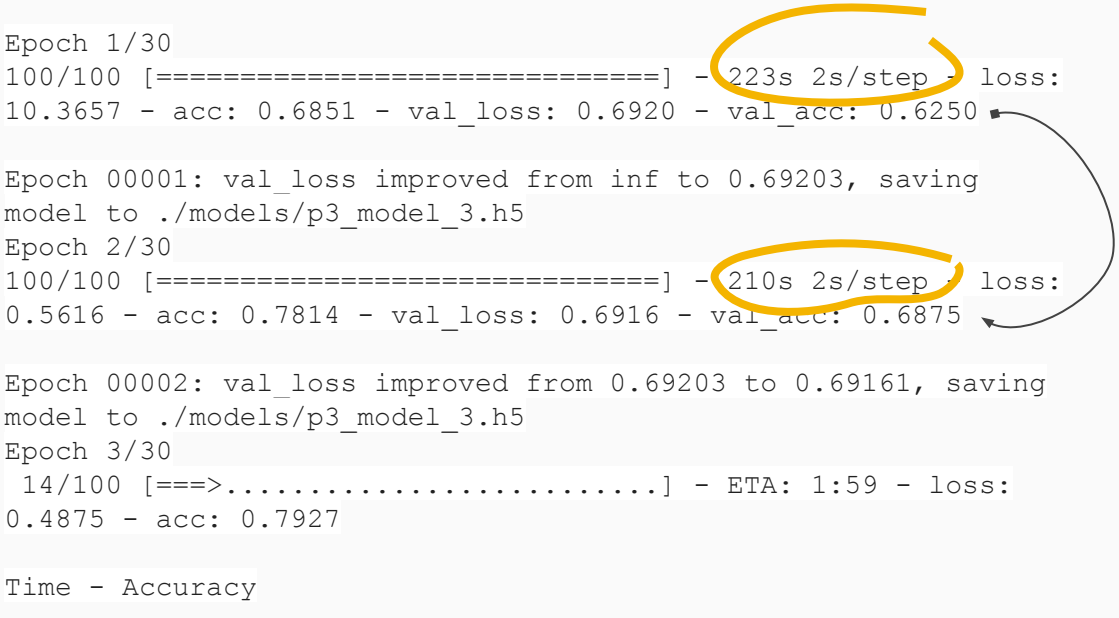


The Tests


Training and validation accuracy along epochs
1.0
0.9
0.8
0.7
0.6
0
10
20
30
40
50
Training acc
Validation acc

Metrics

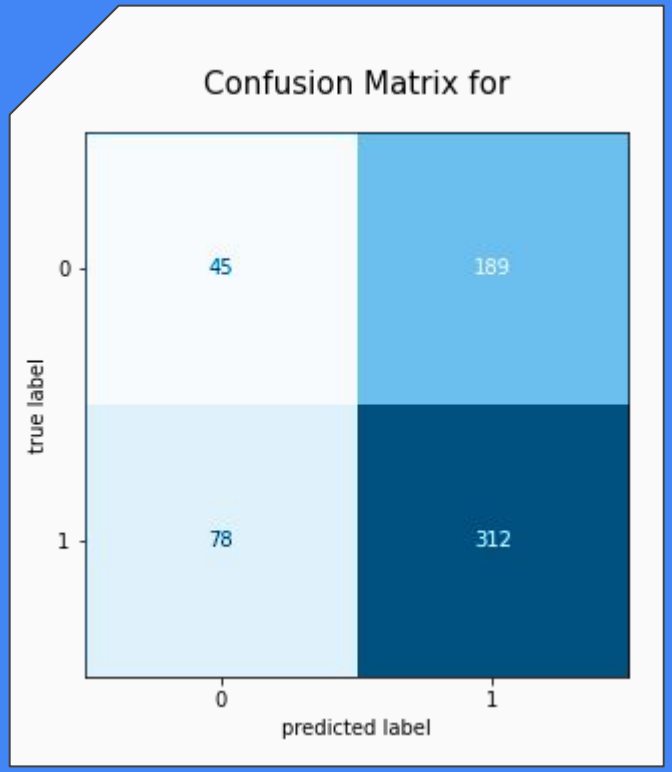
90 minutes training and testing design can result in a reusable model that can make predictions on a dozen x - ray images in fewer than 60 seconds.



Model 1 Results

Predicted 'NORMAL': 123
Predicted 'PNEUMONIA': 501

```
Found 624 images belonging to 2 classes.
test loss: 0.9870075583457947
test acc: 0.8028846383094788
```



‘0’ = normal “1” = Pneumonia

Encouraging, though not ideal:

- **T**rue **N**egatives - correctly predicted to not to have pneumonia: 45
- **T**rue **P**ositives - correctly predicted to have pneumonia: 312
- **F**alse **N**egatives - falsely predicted to not to have pneumonia: 78
- **F**alse **P**ositives - falsely predicted to have pneumonia: **189**

False positives preferred over false negatives.

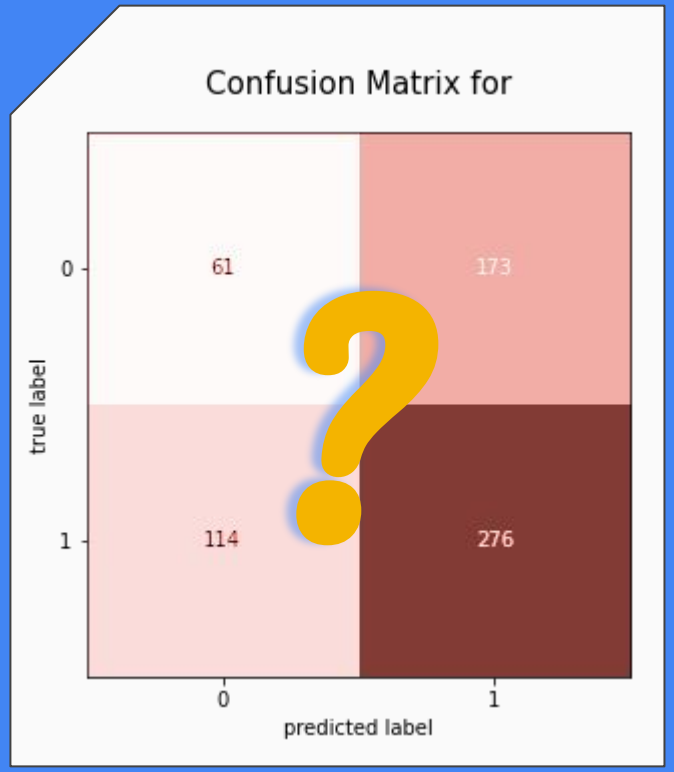
- Where false positives could unnecessarily result in additional testing, false negatives could result in failure to treat patients that require treatment.
- Now, our target is a model that achieves lower error, overall.

A 2nd Model

(*changes must be supervised*)

Predicted 'NORMAL': 175
Predicted 'PNEUMONIA': 449

⬆	TN = 61	(9.78 %)
⬇	TP = 276	(44.23 %)
⬆	FN = 114	(18.27 %)
⬇	FP = 173	(27.72 %)



While stable models may be deployed to clinical teams and run without the need for adjustment, model design is supervised to ensure changes do not adversely affect test results.

Future Work

- Models can be saved, for distribution to multiple practices.
- Tuning may continue, following initial deployment, to continue optimizing the model.
- Revisions may be deployed with little to no time lost--just test the new images on the latest model version.

This is not the end.

Thanks!

Contact us:

My Business
2 Your Health
Sitea, ST 12345

your@thelastslide.edu
www.github.com