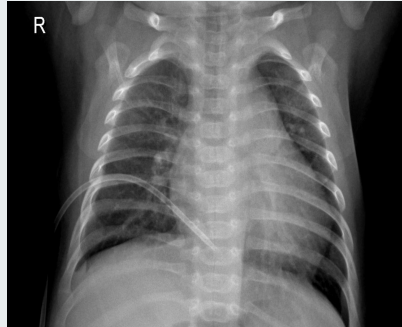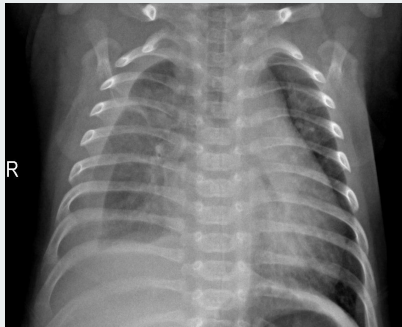# Chest X-Ray Classification for Pneumonia

A Deep Learning Approach

Problem Statement:

- Imaging data is exploding
- 90% of all healthcare data
- Hospital generate 50 petabytes/yr
- Need for rapid analysis
- Technicians and physicians are overwhelmed
- Leads to errors
- Can be difficult to interpret

Proposed Solution

- Deep Learning Algorithms
- Great image classifiers
- Trained on extensive dataset

Benefits

- Rapidly process thousands of images
- Triage to ID most urgent cases
- Reduce load on Techs and Drs
- Pattern detection beyond human capability
- Remote diagnostics
- Continuous improvement with use

Approach

- Gather data - X-ray imgages
- Build several DL models
- Models need to differ
- Train on images
- Evaluate models
- Select best performing

Evaluation Metric

- Several to choose from
- Precision
- Accuracy
- F1 Score
- Recall

Choosing the Metric

- Err on side of false positive
- Minimize false negative
- Precision measures percent of false positive
- Accuracy is overall and prone to errors
- F1 for balance
- Recall measures percent of false negative
- Recall score of 1.0, no false negatives.
- 1.0 is the target!

Recall!

The Data

- Available for download at Meneley.com
- 8 Gigs of data
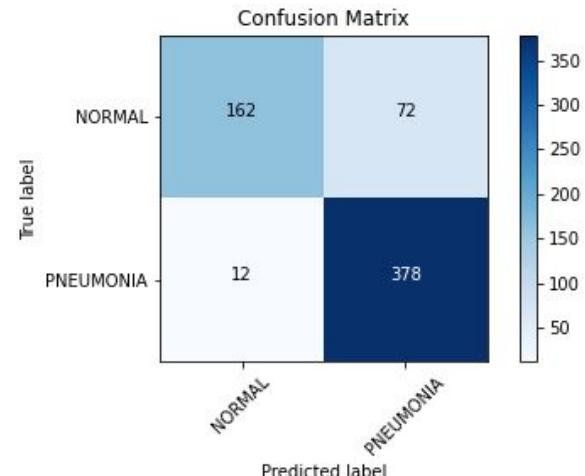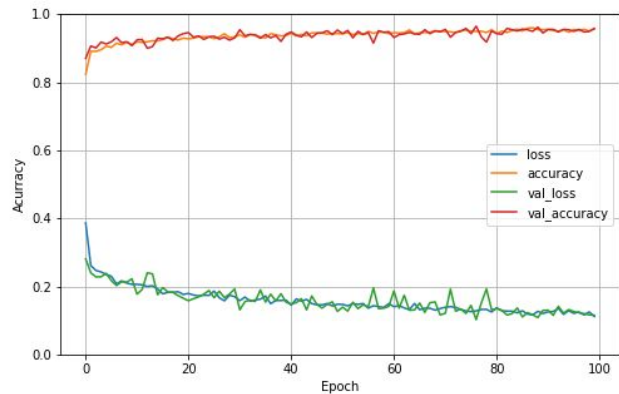- Very imbalanced
- Positives much greater

The Models

- Four CNN models
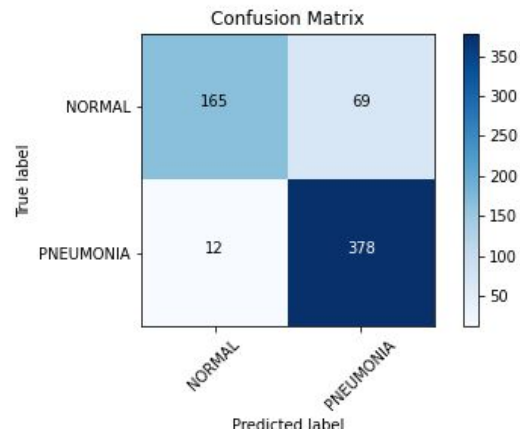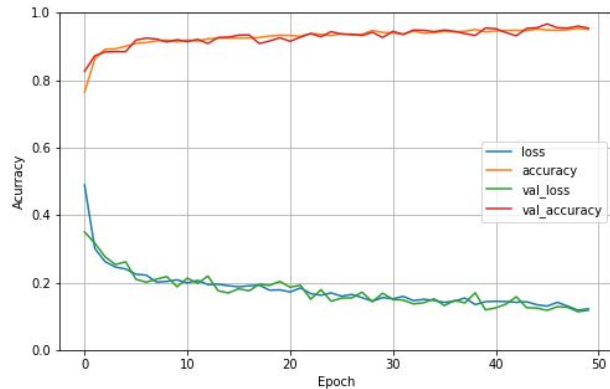- Two from scratch
- Two pretrained

Model 1

- Two conv layers
- No pre-training

- Generalizes well
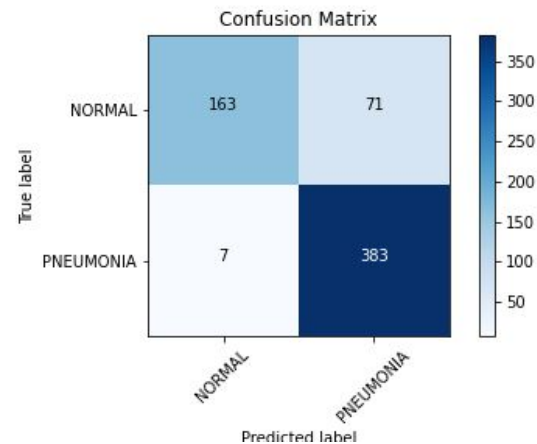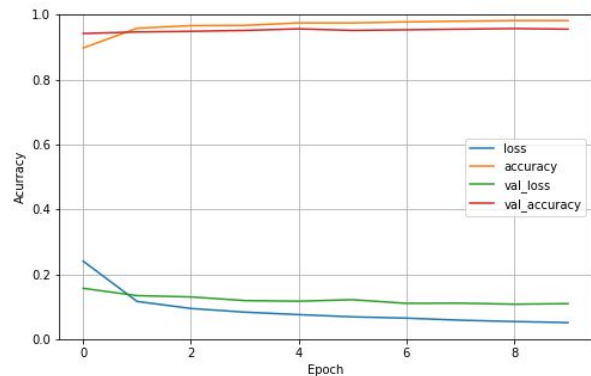- Recall score of 0.97
- Bit low

Model 2

- 4 conv layers
- No pre-training

- Generalizes well
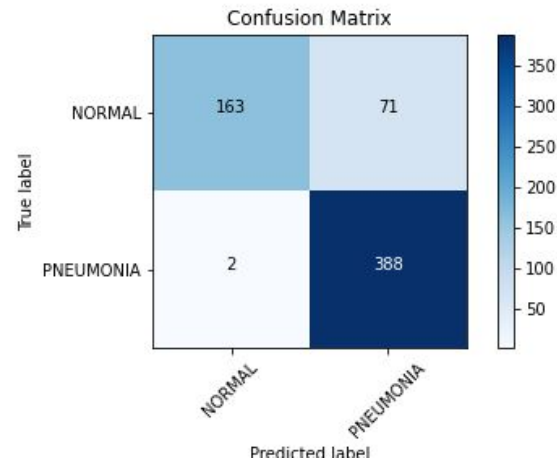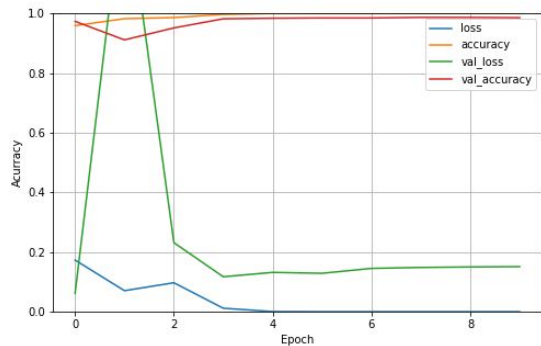- Recall score of 0.97
- Same as Mod 1

Model 3 - VGG 16

- Pre-trained
- All layer frozen
- Add our data

- Generalizes well
- Recall score of 0.98
- Better, but can do better

Model 4 - Also VGG 16

- Pre-trained
- 2 less frozen layers
- We add our data

- Generalizes well
- Recall score of 0.99 (closer to 0.995)
- Best candidate

Analysis

- Model four had best score
- Other models a bit high
- Want to error on false negative
- All four do that… but
- Only model four can be considered

Conclusion

- Model four wins
- Low enough score to be considered
- Further training to improve
- Minor tweaks

Future work

- Train models on other deseases
- Explore MobilNet models
- Explore CNN /XGBoost composite models (Hybrid)
- Produce class activation heatmaps for explainability

Thank you

I appreciate having the opportunity to present the findings of this POC. I hope that you have found it of interest and that you will consider the findings herein.

Good Night.