Classifying Chest X-Rays

Authors: Griffin Hundley
Malcolm Katzenbach

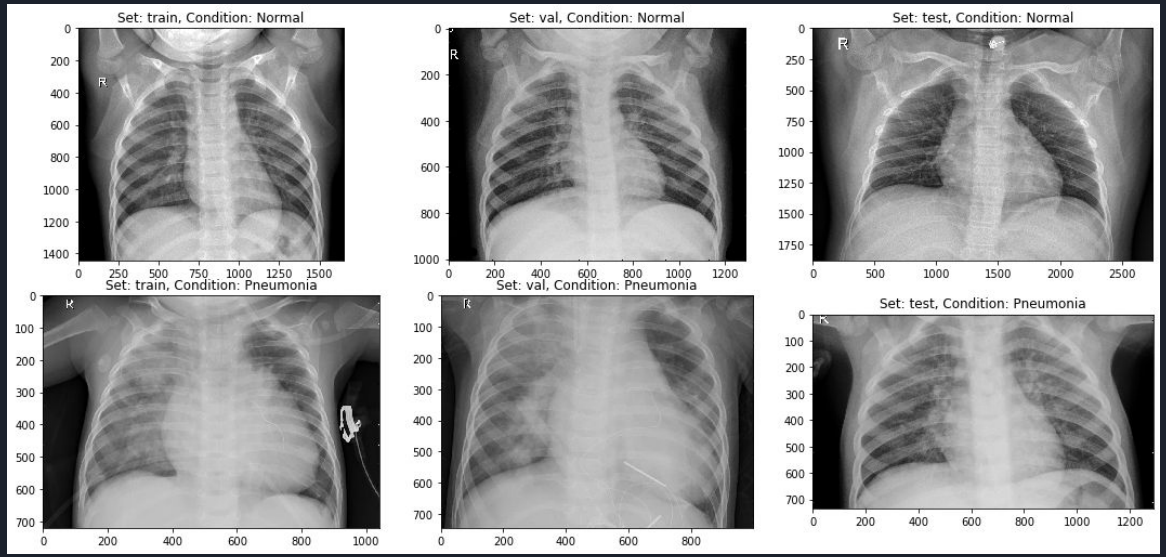
Problem

- There are about 1 million Americans admitted to hospitals for pneumonia every year.
- Of those, as many as 50,000 patients die
- Chest X-rays are one of the methods that medical professionals use to diagnose pneumonia.
- Target: Build a classification model that can predict the presence of pneumonia in a chest x-ray image.

Data

Images Split into 3 groups:

Training:	1299 Normal
	3833 Pneumonia
Validation:	50 Normal
	50 Pneumonia
Test:	234 Normal
	390 Pneumonia



Medical Professionals check for “Ground Glass” Opacities, white spots, fluid cavities

Model

Final Model:

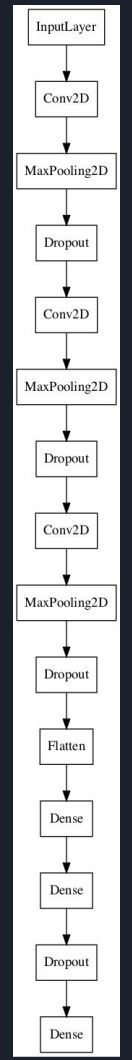
3 2D Convolutional Neural Nets, 2 fully connected (“Dense”) Neural Nets with “ReLu” activation

Output Layer: Dense Binary with Sigmoid activation

Dropouts used after each layer to reduce overfitting

Metrics Measured: Accuracy, Precision, Recall, AUC

Most Important Metric: Recall (Reducing False Negatives)



Results

Accuracy Score: 88.9%

Precision Score: 85.4%

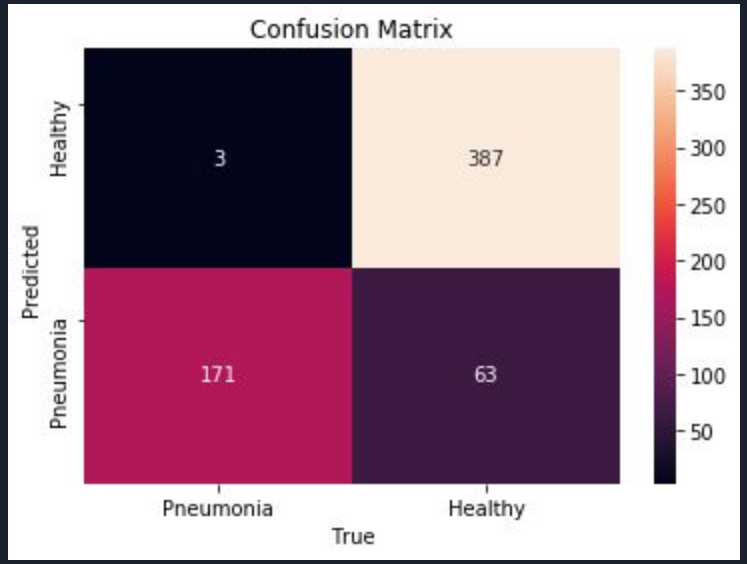
Recall Score: 99.2%

AUC Score: 94.1%

Errors:

Lung scarring and congenital heart failure looks similar to Pneumonia opacity. Chest X-rays can be non-specific for viral pneumonia.

Images were downscaled to 64x64 px



Conclusions

- Performs well as a net for detecting pneumonia in chest x-rays
- Has somewhat high amount of false positives (can be reduced by increasing threshold at the expense of false negatives

Future Steps

- Potential random transformations of training images
- Higher resolution images
- Model architecture (change regularization method)
- Hyper-parameter tuning, early-stopping

Contacts

Griffin Hundley

gitHub: griffinhundley

Email: hundlegq@dukes.jmu.edu

Malcolm Katzenbach

gitHub: Malcolm206

Email: mkatzenbach8@gmail.com