Identifying Pneumonia In Pediatric Chest X-Rays With Neural Networks

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Presentation Outline

- Business Understanding
- Purpose Of Analysis
- Data & Methods
- Results
- Recommendations
- Future Steps

Business Understanding

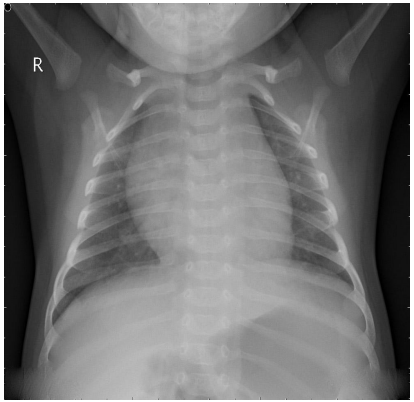
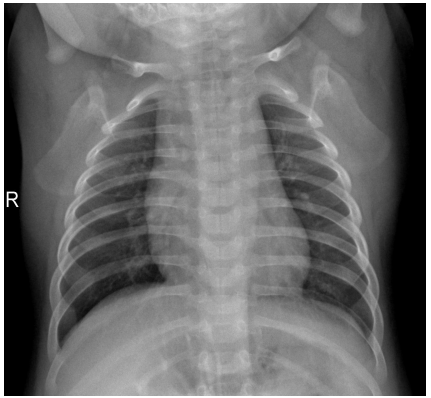
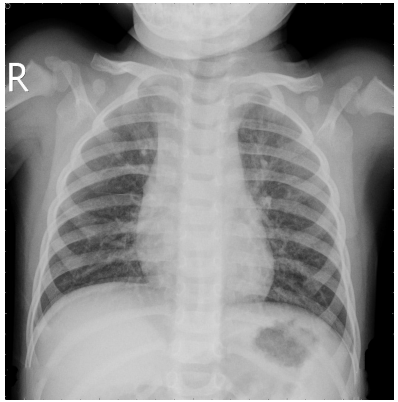
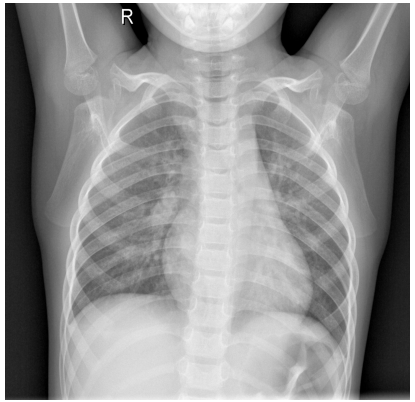
What is pneumonia?

- Fluid in lungs
- Difficult to diagnose in children

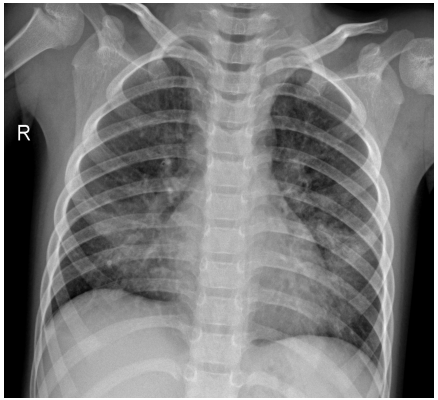
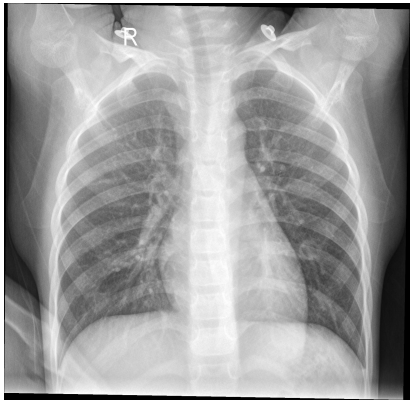
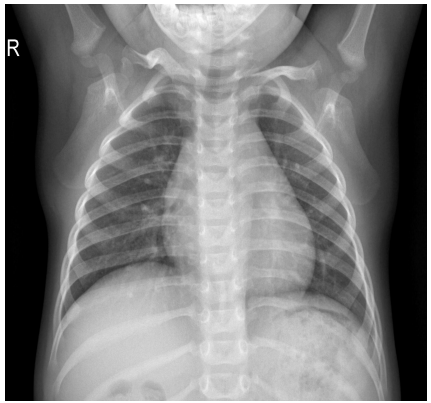
Diagnosis:

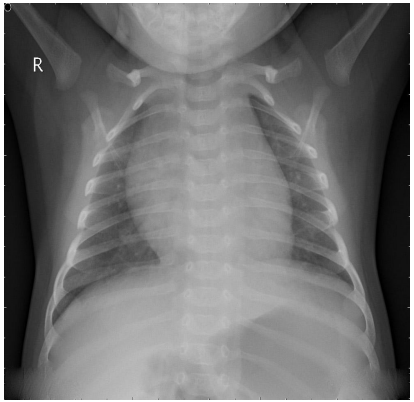
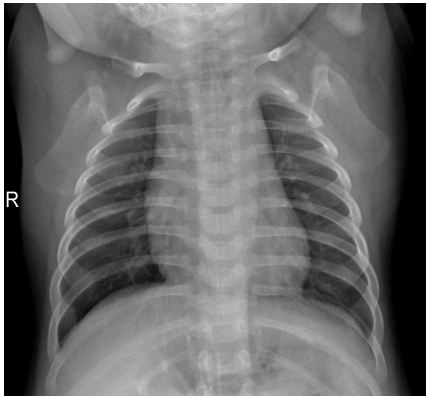
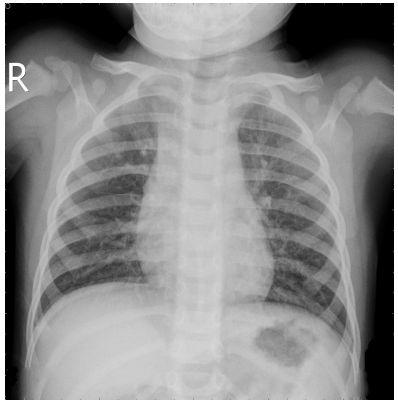
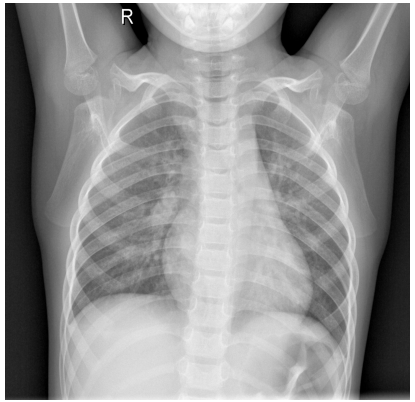
- Observed symptoms
- Chest x-ray (CXR)

"Epidemiology and etiology of childhood pneumonia"

Which one of these radiographs is positive for pneumonia?

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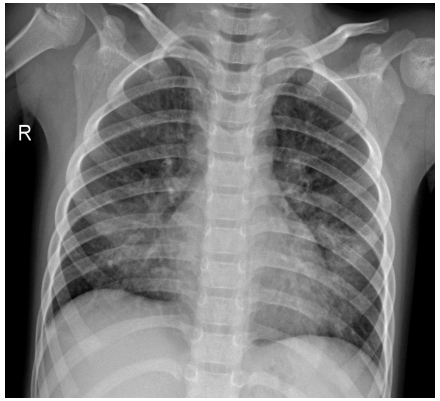
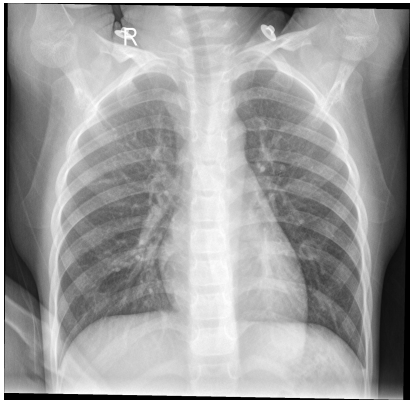
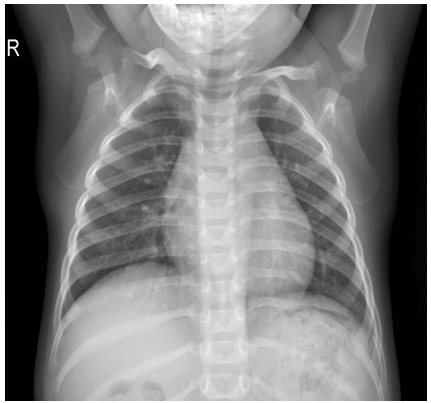
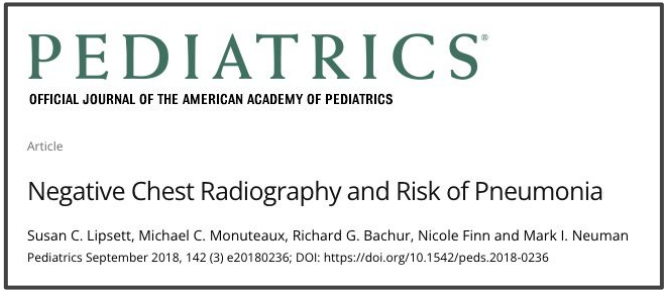





Purpose Of Analysis

Predict pneumonia from pediatric CXR


PEDIATRICS

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Article

Negative Chest Radiography and Risk of Pneumonia

Susan C. Lipsett, Michael C. Monuteaux, Richard G. Bachur, Nicole Finn and Mark I. Neuman

Pediatrics September 2018, 142 (3) e20180236; DOI: https://doi.org/10.1542/peds.2018-0236

Negative Chest Radiography and Risk of Pneumonia

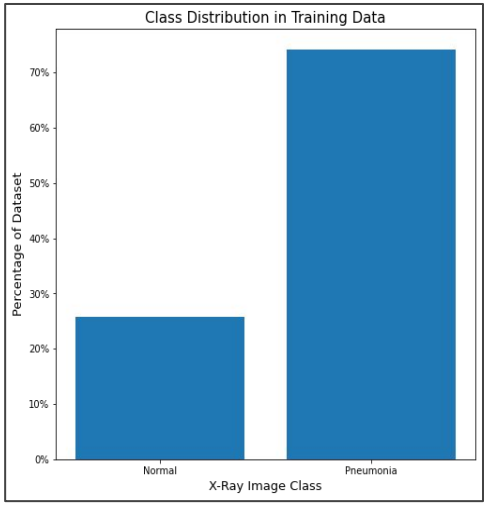
Stakeholder: Guangzhou Women and Children's Medical Center, Guangzhou, China

Key Metric: Recall (reduce false negatives)

Data & Methods

Data provided by Kaggle: Guangzhou Women and Children's Medical Center

Number of Images: 5,863



Class Balance

- Training
- Testing

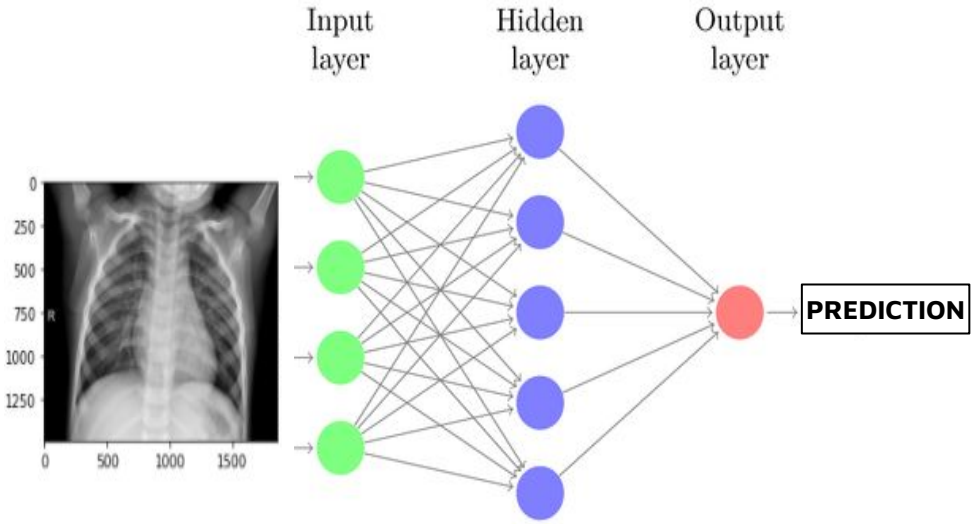
First Simple Model

Fully Connected Dense Neural Network

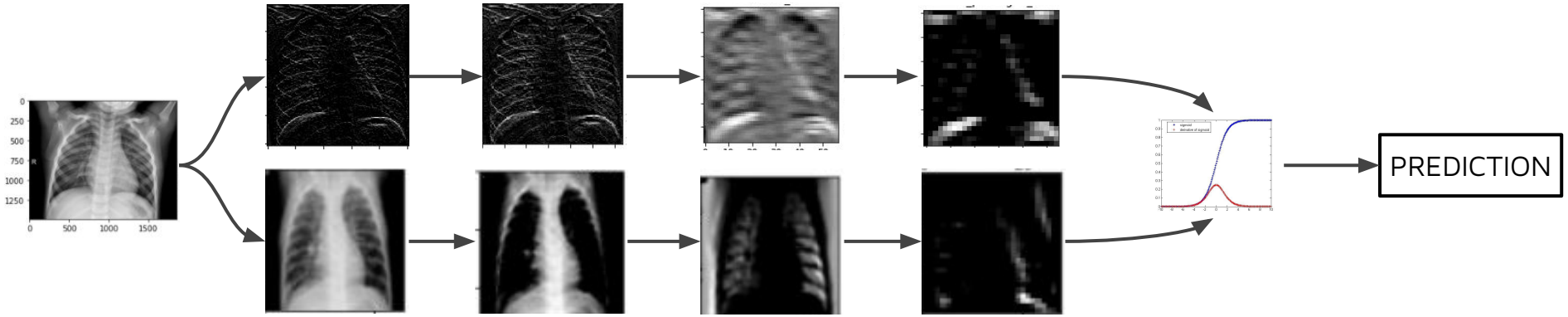
- Single layer
- Evaluated on only 50 images

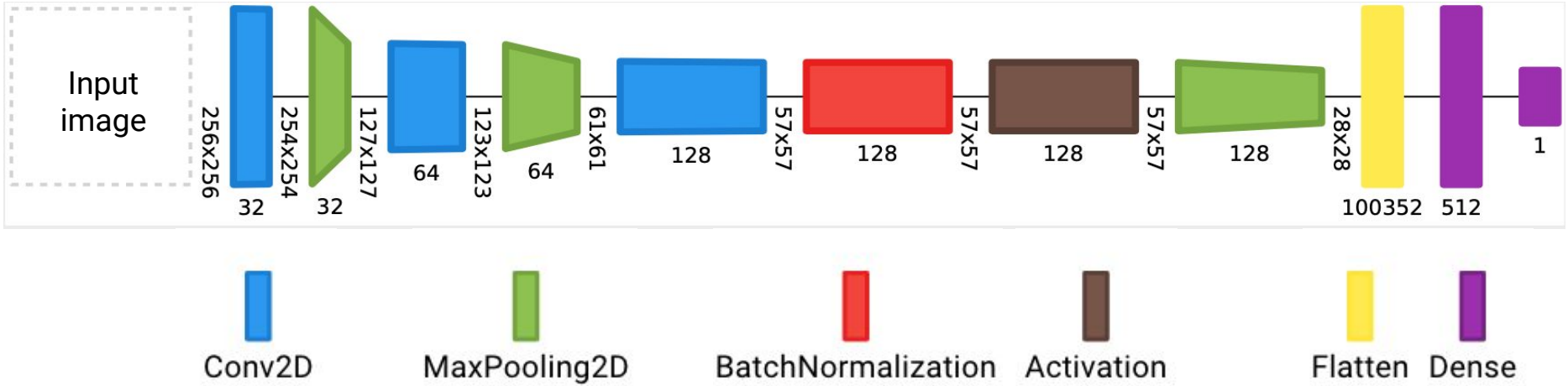
Validation Accuracy: 94%

Validation Recall: 95%



Final Model: What is it doing?





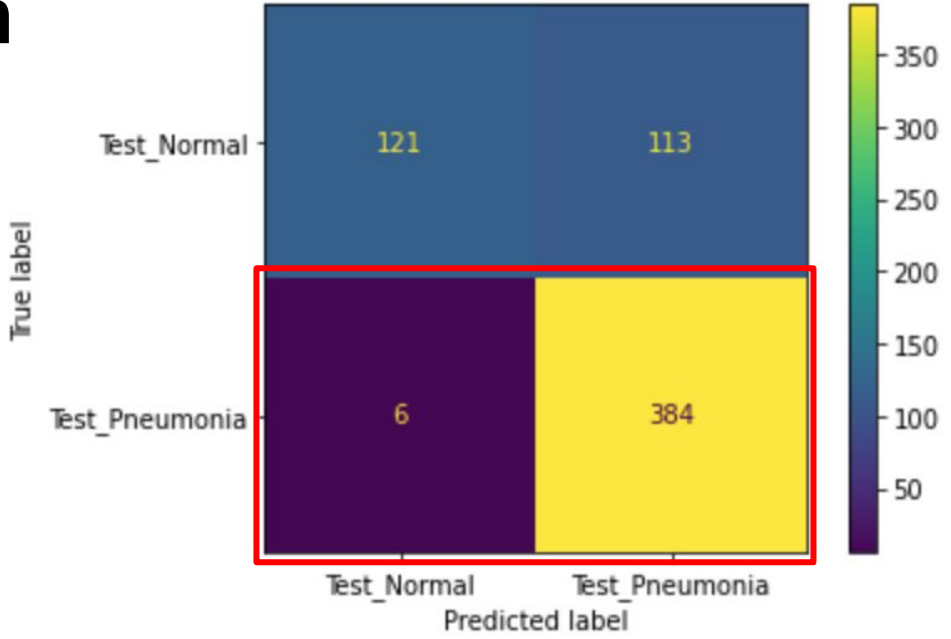
Net2Vis -- A Visual Grammar for Automatically Generating Publication-Tailored CNN Architecture Visualizations

Alex Bäuerle, Christian van Onzenoodt, Timo Ropinski; Cornell University

Final Model: Evaluation

Convolutional Neural Network

- Multiple layers
- Full dataset



Testing set accuracy: 80.93%

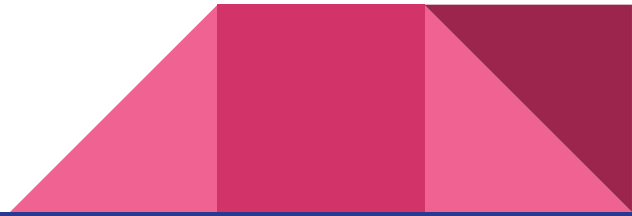
Testing set recall: 98.46%

Recommendations

- Use model as part of diagnostic toolkit, in conjunction with a clinical assessment

- Use model to reduce the number of false negatives among patients with pneumonia

- Use model to increase the speed of predictions



Next Steps

- Classify bacterial vs. viral pneumonia:
- Consult with a medical expert to identify patterns in misclassified images
- Crop or zoom in on images
- Apply this strategy for adults with potential

  covid-19 diagnosis

Thank you!

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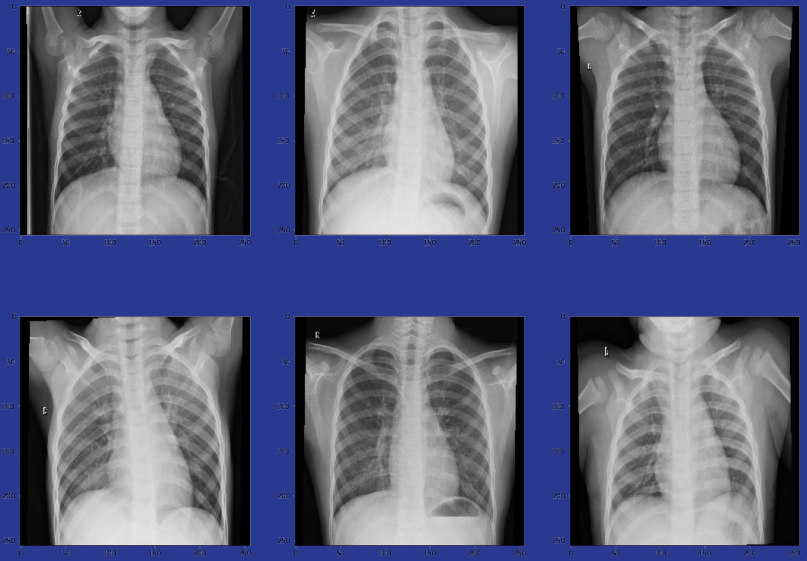
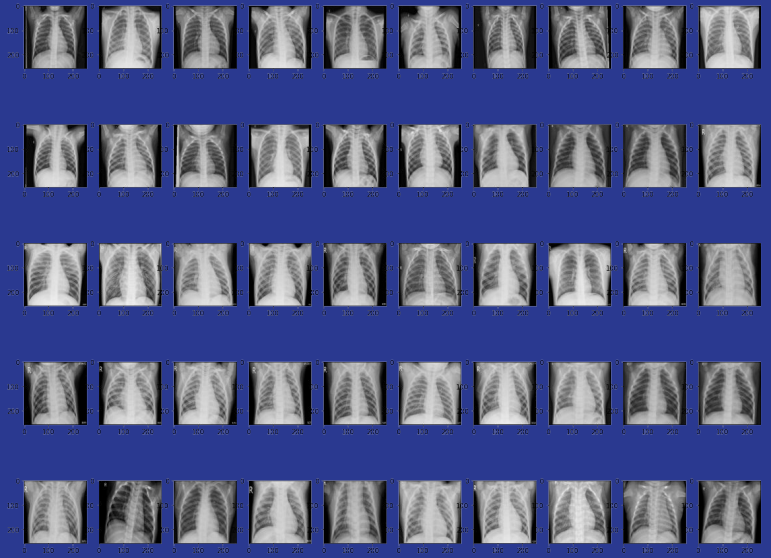
Appendix: Misclassified Images

These images were misclassified by our model.

False Negatives



False Positives



(50 out of total false positives)