Pneumonia Classification with Deep Learning

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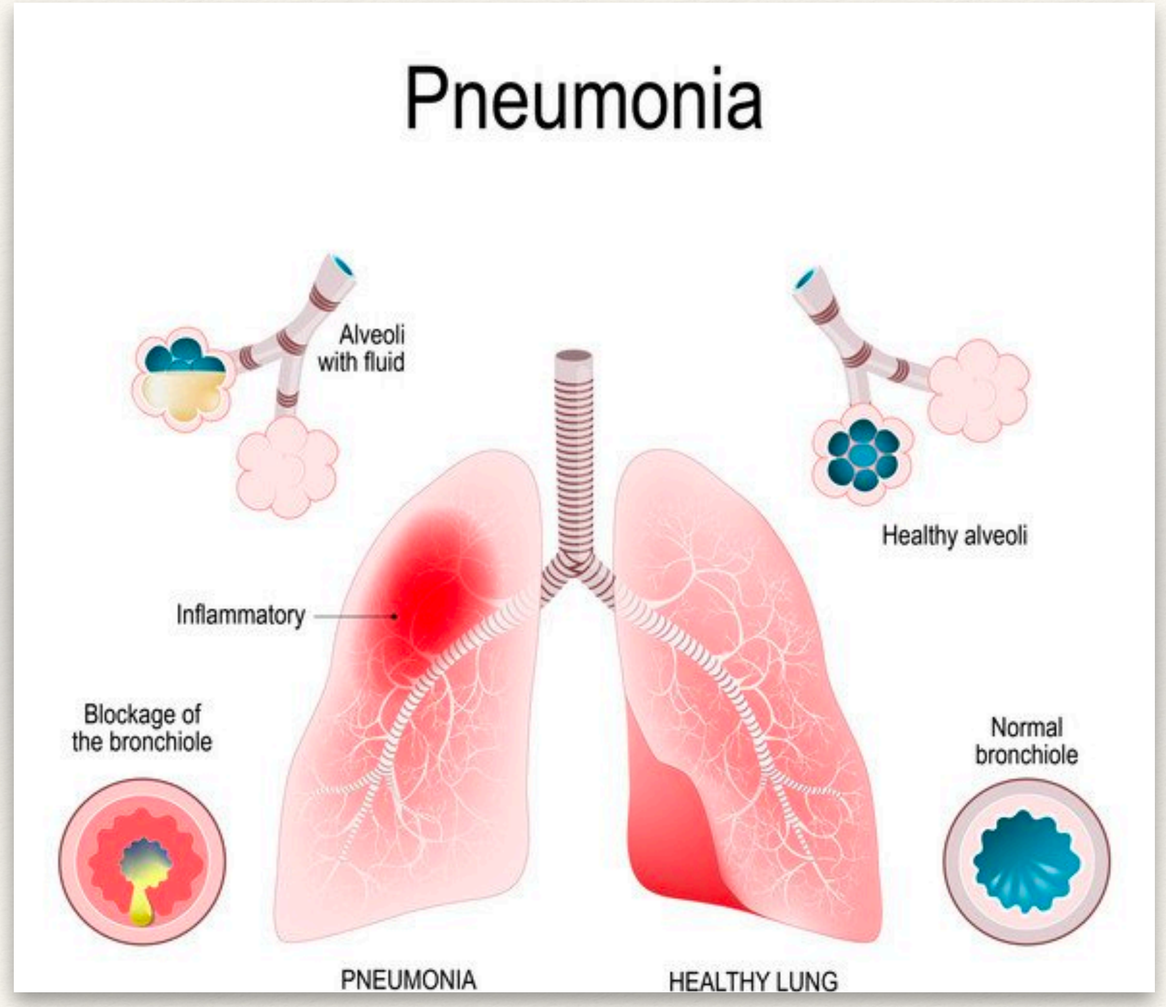
Causes and symptoms

- Inflammation of the lungs —> alveoli fills with fluid.
  - Decreased CO2 and O2 exchange in blood.
- Shortness of breath, fever, cough, chest pain.
- Higher risk for elderly individuals and those with pre-existing conditions.



Diagnostic Methods

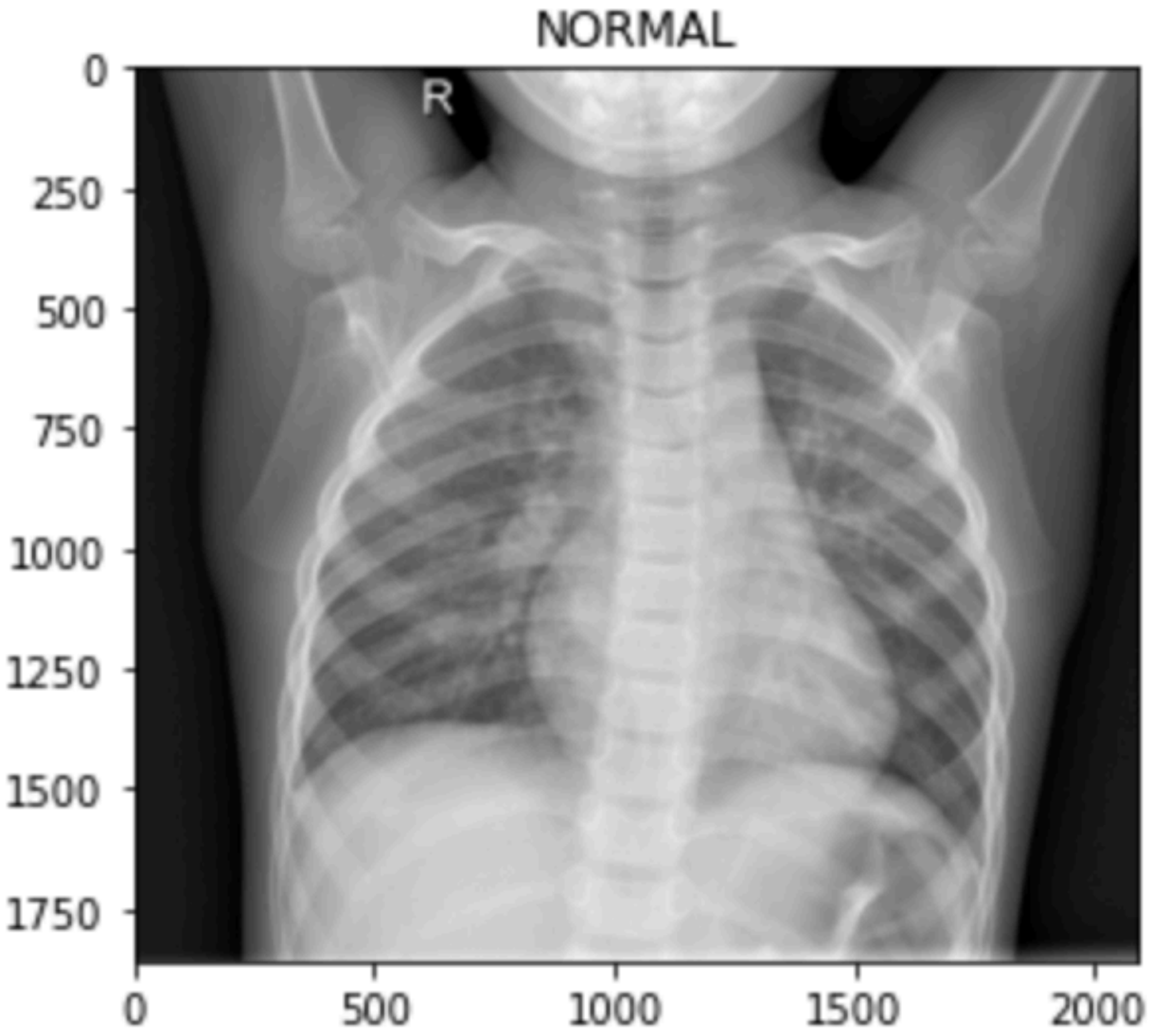
- Chest x-rays are fast, inexpensive, reliable.
  - Deep-learning assistance provides automation.
- Sputum, blood cultures, and bronchoscopy more invasive.

Significance

- Testing and diagnosis are prophylactic.
  - Early diagnosis and isolation can help prevent spread of disease.
- Deep learning models potentially helpful for clinics with few resources.

Methods

- Two types of neural networks compared: Multilayer Perceptron (MLP) and Convolutional Neural Network (CNN).
- Constructed, trained, and tested for prediction accuracy on 6000 images.
  - **Training (*n*≈5000):** Learn how to predict pneumonia.
  - **Testing (*n*≈1000):** Try to predict pneumonia.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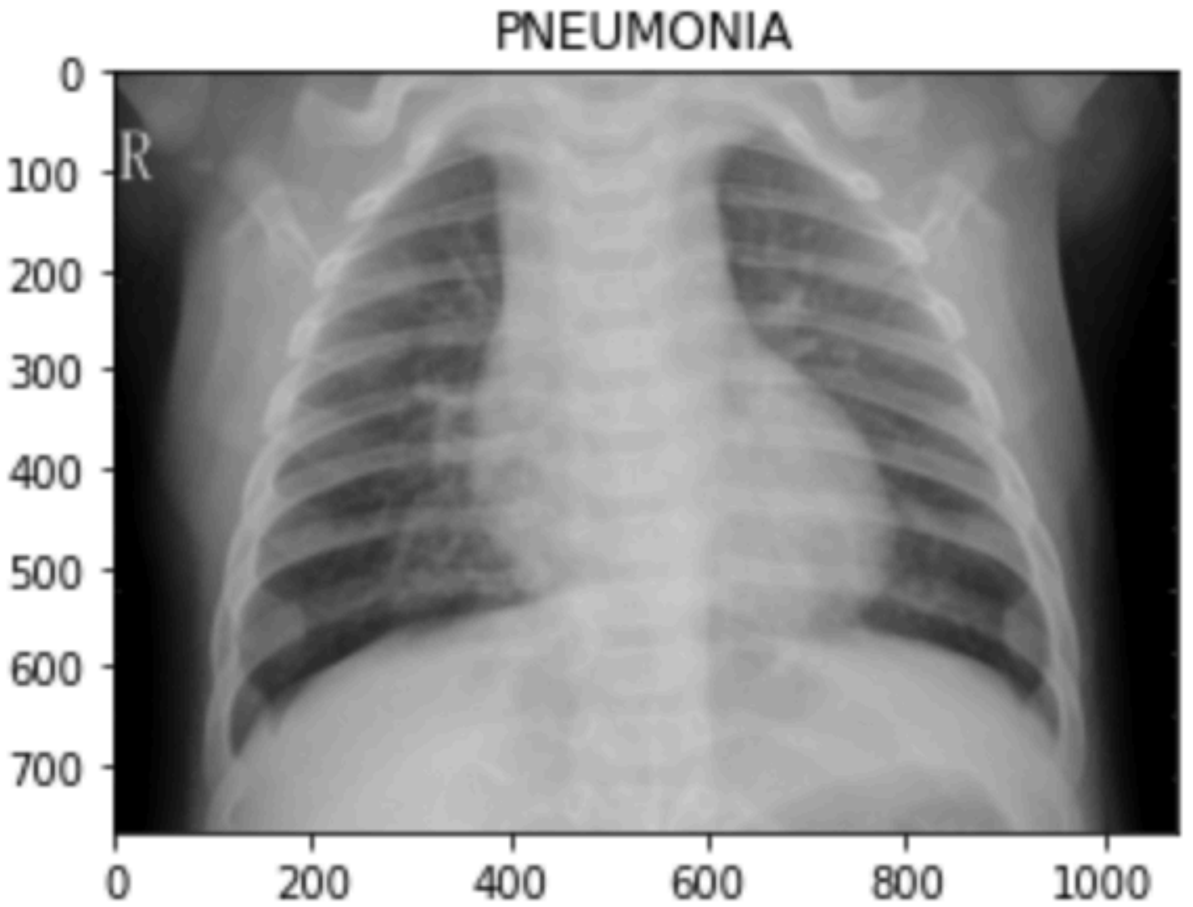
PNEUMONIA
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Multilayer Perceptron

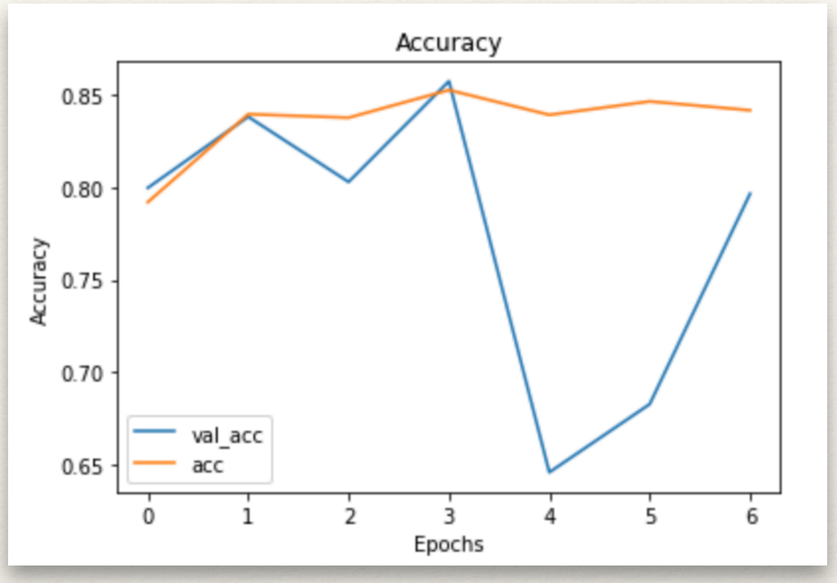
- **Pros**
  - Great for detecting broader patterns
  - Fewer computational resources required
- **Cons**
  - Not as cognizant of spatial information
  - Can easily “over-learn” training data
  - Can take longer to find solution

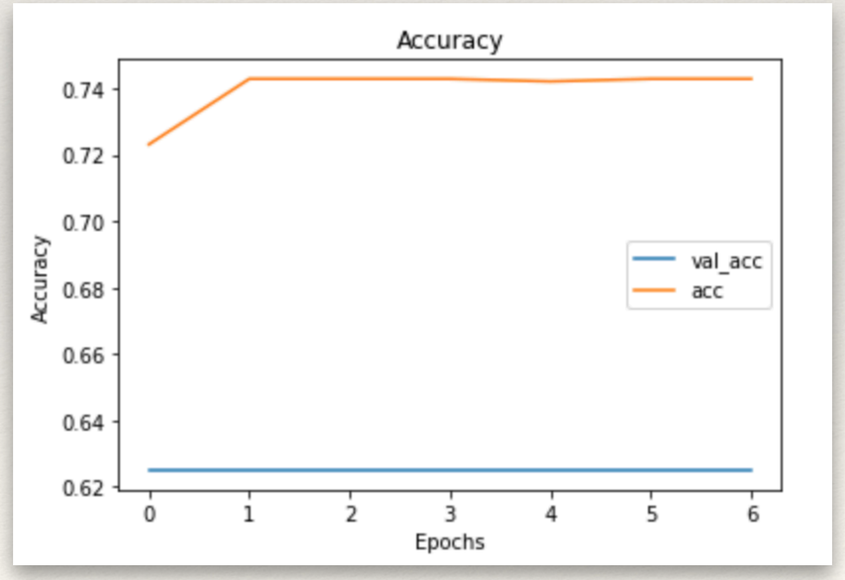
Convolutional Neural Network

- **Pros**
  - Excellent at computer imaging
  - Great at detecting smaller patterns in data
  - Finds solution faster than MLP
- **Cons**
  - More computationally expensive than MLP

Results

- CNN (top) was **87.06%** accurate on training data, **85.74%** on testing data.
- MLP (bottom) was **74.29%** accurate on training data, **62.50%** on testing data.
- CNN had less error for testing data than MLP.





Selection and Future Work

- CNN prototype to be used for pneumonia classification.
- Technical approaches for model optimization.
  - Pre-trained models are highly effective.
- Broader implications for detection of other diseases, including COVID-19.

References

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Thank you!

- **Github repository: PneumoniaNeuralNet**
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