Pneumonia Detection
Using Neural Networks

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Outline

- Purpose of project
- Data
- Preprocessing + Data Normalization
- Models
- Results
- Conclusion

Purpose

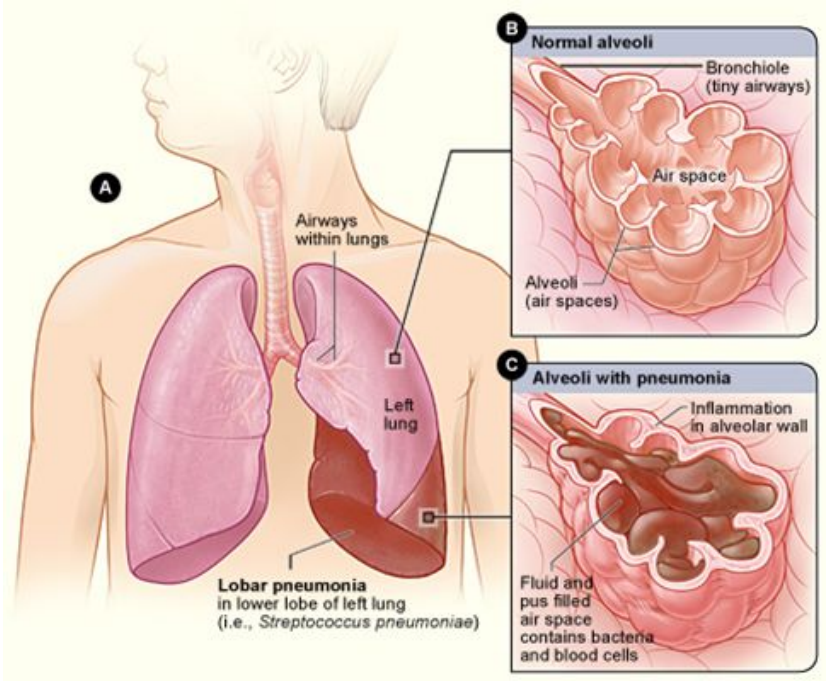
Aid medical professionals with pneumonia diagnosis’ by creating a machine learning algorithm to detect pneumonia from patient’s chest X-ray images. Our goals:

- Reduce error caused by misinterpretation of X-rays
- Streamline diagnosis process
- Lighten the workload of physicians

Motivation

Pneumonia is most common cause of hospital admissions other than women giving birth.

- Can be identified by inflamed air sacs in one or both lungs, often filled with fluid or pus. A variety of organisms, including bacteria, viruses and fungi can cause pneumonia.



Data

- Data is sourced from Kaggle and collected from Guangzhou Women and Children's Medical Center. It contains a total of 5,856 images that are classified as either "Normal" [0] or "Pneumonia" [1]
  - X-ray images are of pediatric patients with ages ranging from 1-5 and were performed as part of patient's routine clinical care
  - Images were pre-screened and all low quality or unreadable scans were removed
  - Scans were graded by 3 medical professionals prior to use
- Class balance:
  - Train = 26% Normal vs 74% Pneumonia
  - Test = 38% Normal vs 63% Pneumonia

Chest X-rays

Normal

Bacterial

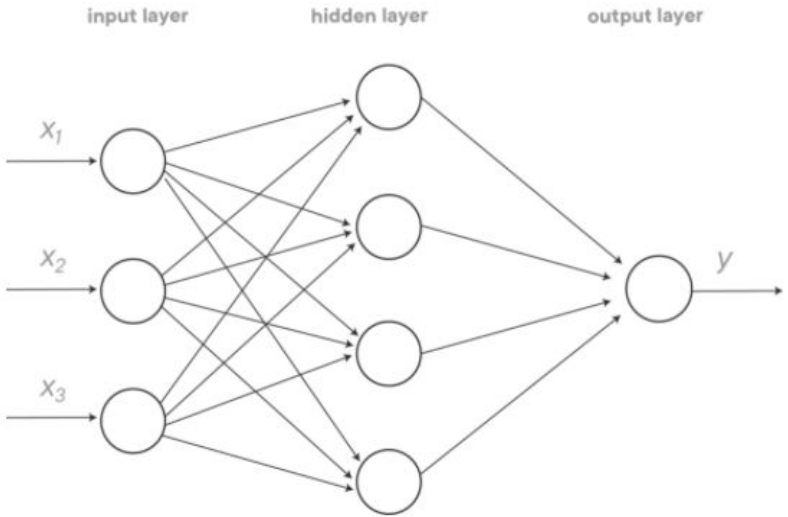
Viral

Initial Model - Dense Neural Network

Dense Neural Network: each neuron in a layer will receive an input from all the neurons present in the previous layer

Total parameters: 24,778,201

- Train accuracy: 25.71%
- Validation accuracy: 50%



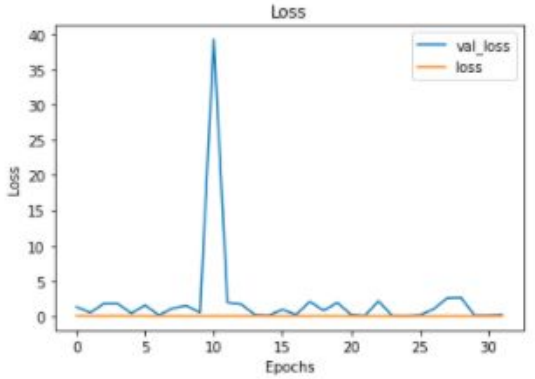
Final Model - Convolutional Neural Network

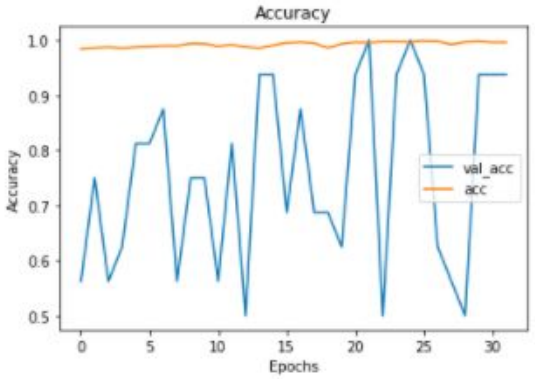
CNN: learns local patterns within the data and can share information across different regions. Increasing number of layers allows algorithm to learn larger patterns by using what it learned in previous layers

Total trainable parameters: 1,450,913

Architecture: 4 convolutional layers, batch normalization, dropout and dense layers

- Train accuracy: 99.98%
- Test accuracy: 77.88%





Conclusions/Future Improvements

- Currently our model is able to detect pneumonia in patients - solely based off their chest x-rays - with 78% accuracy
- Next steps:
  - Further increase accuracy
    - Reduce overfitting
    - Slowing learning rate
    - Add additional layers
    - Pre-trained networks

Thank You

Resources:

- GitHub repo: https://github.com/klsalcedo/pneumonia_classification