

Image Classification with Deep Learning: Detecting Pneumonia in X-ray Images

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Stakeholder:

Be Well Healthcare Center, Radiology Department

Business Problem:

Looking for an efficient way to screen chest x-ray images for pneumonia detection in pediatric patients.

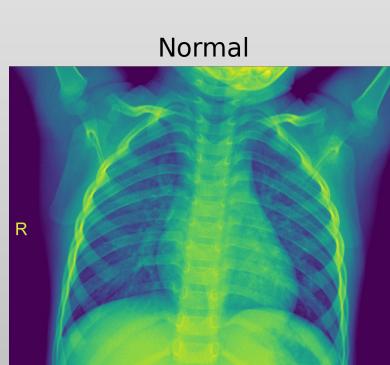
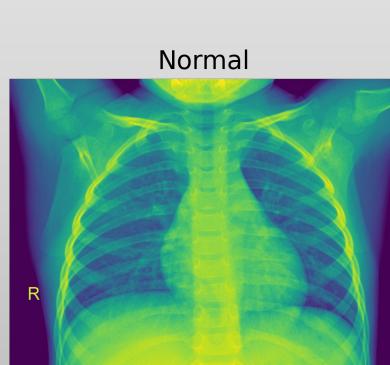
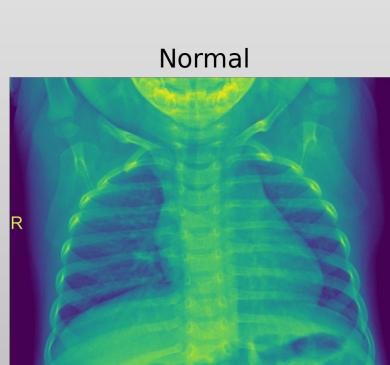
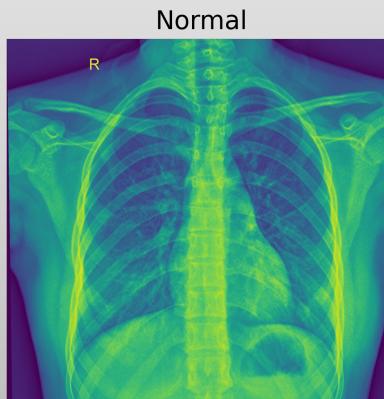
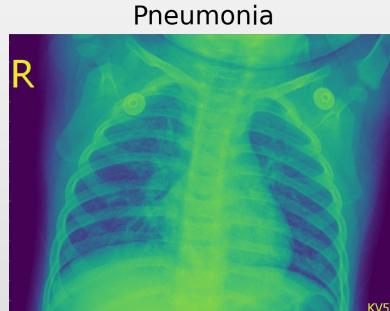
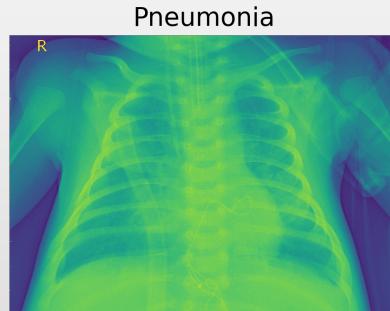
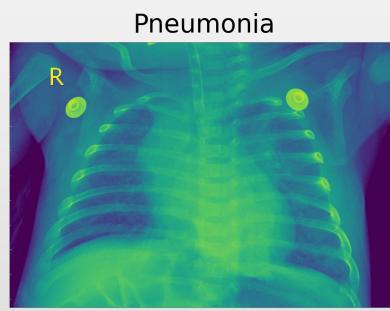
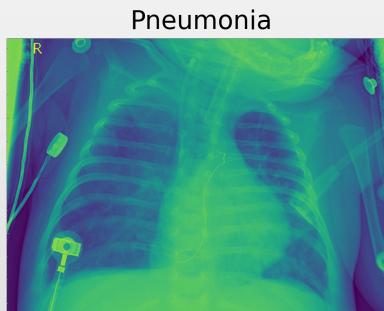
Project Value:

- Decrease the workload of its radiologists.
 - Minimize diagnosis time and allows for faster treatment.
 - Lower the risk of human errors and improve patient safety.
-

Data:

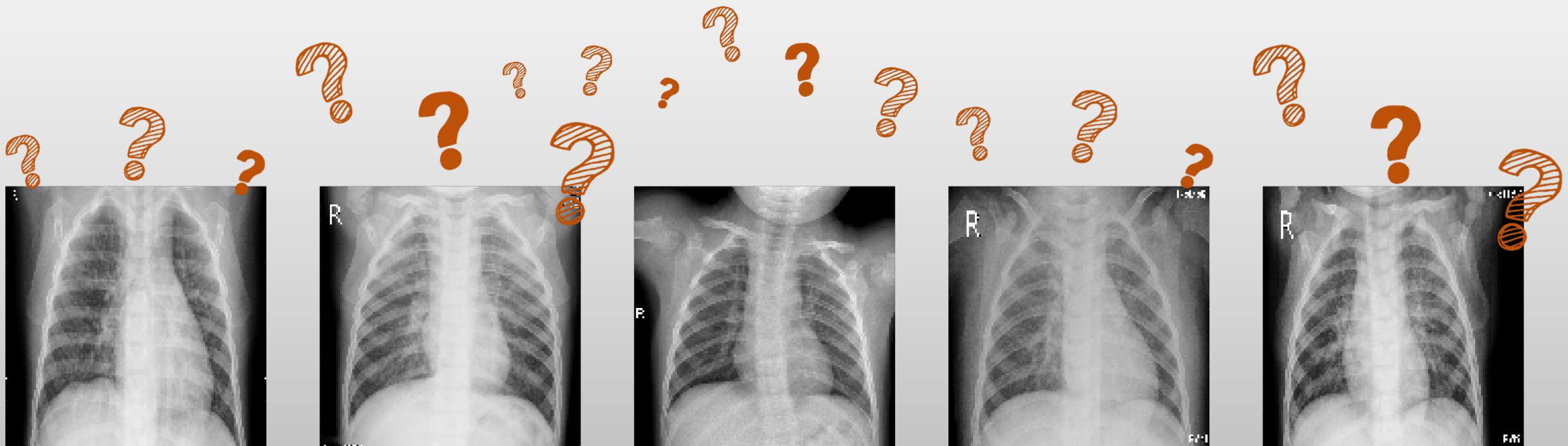
Kaggle Dataset of Chest X-Ray Images:

- ✓ Chest X-ray images from 5,863 pediatric patients separated by the image categories that they belong to (Pneumonia/Normal).

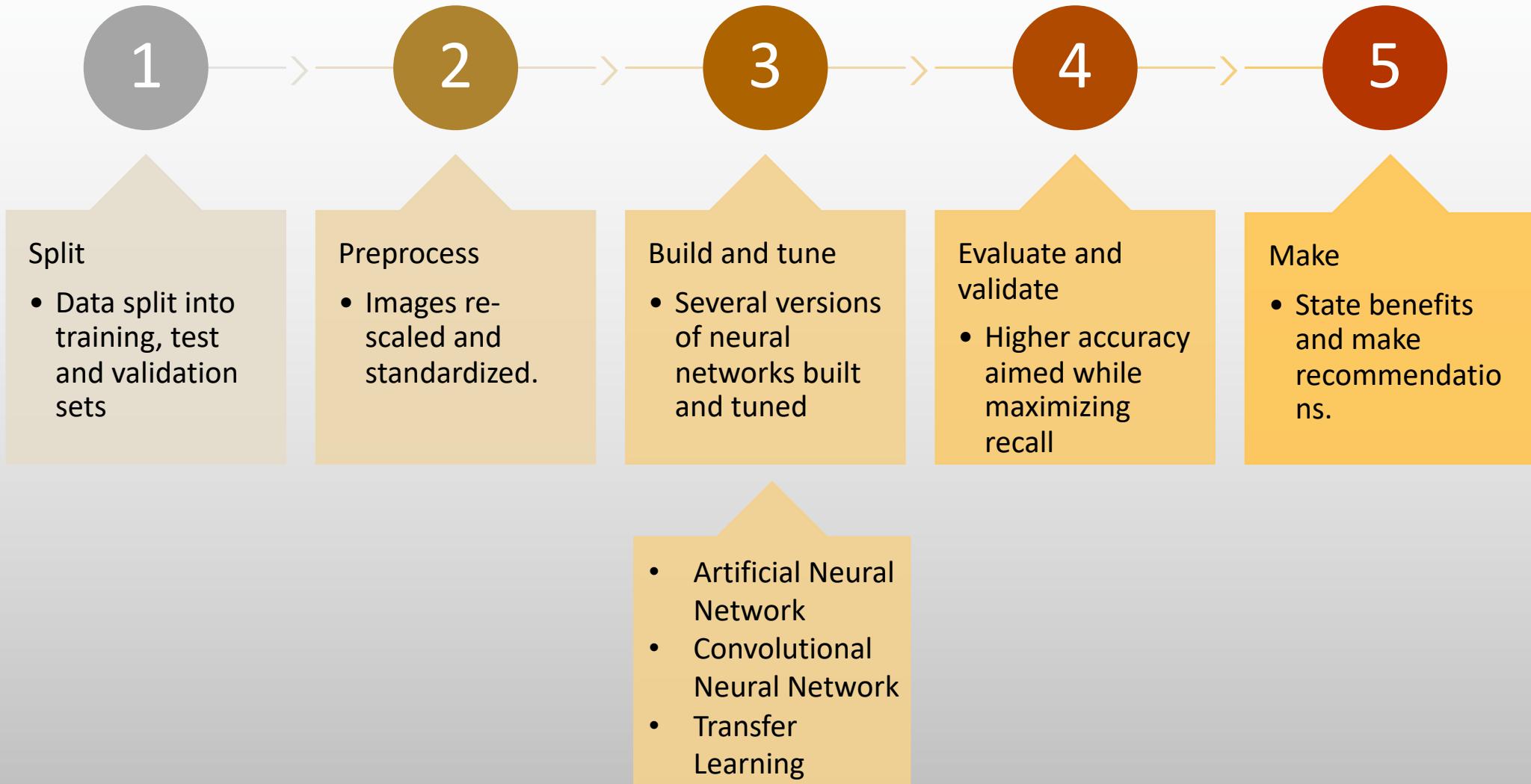


Goal:

- Generate a **Neural Network** that detects the presence of pneumonia in X-ray images.
- **Target Accuracy:** Accurately predict the status of the lungs (**Normal vs pneumonia**) (on the test set).
- **Maximize Recall:** Identify majority of the **True Positive** cases correctly so that we catch as many kids with pneumonia as possible.

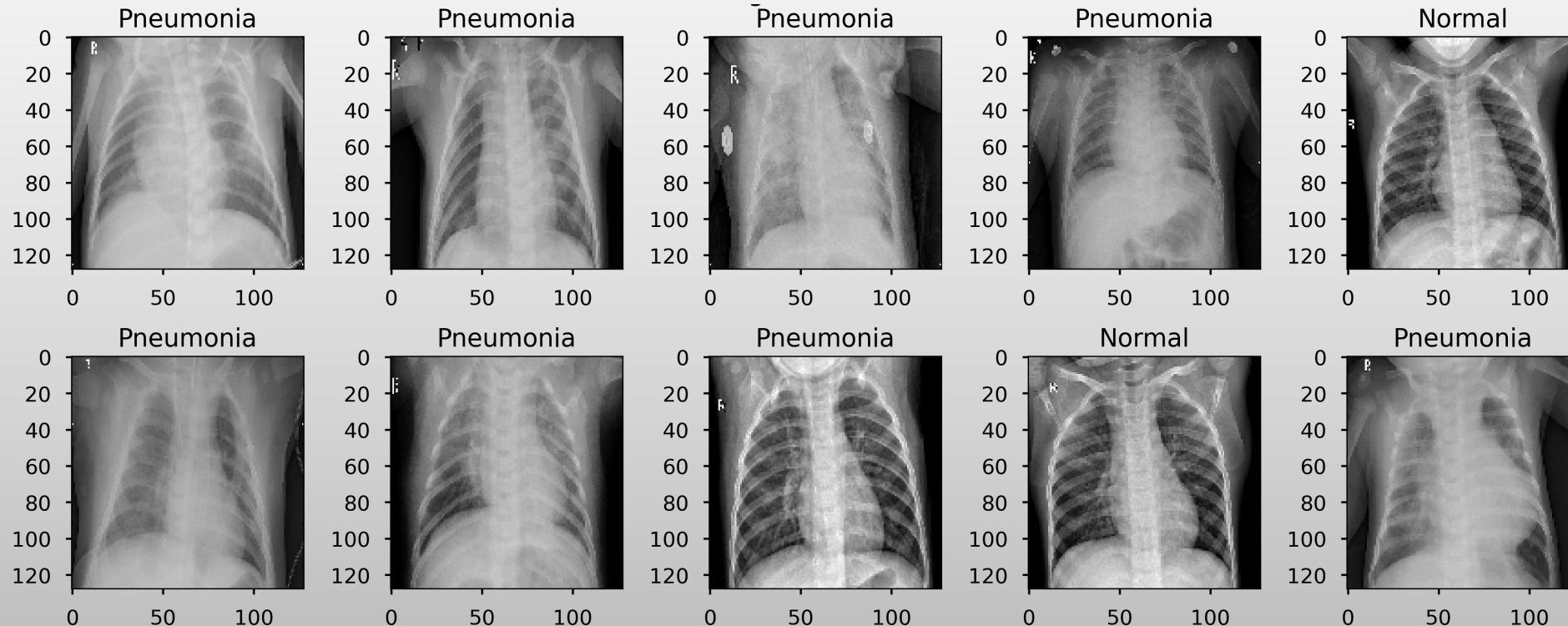


Methodology:



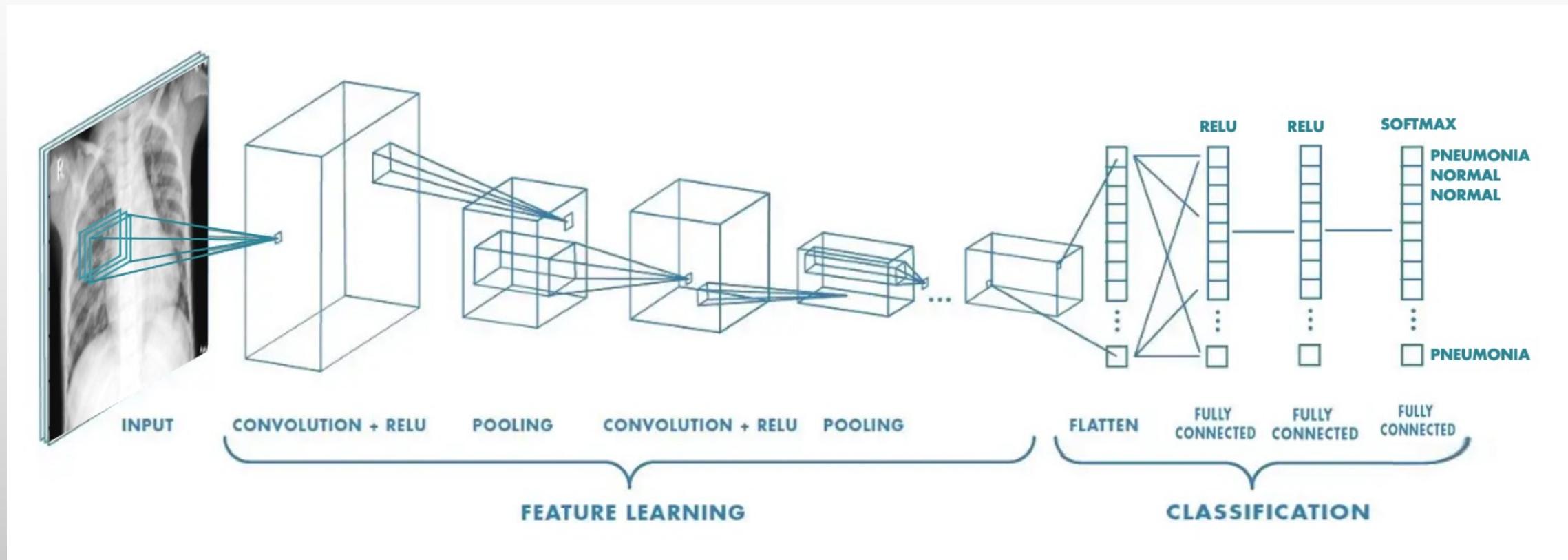
Split and Preprocess:

- ❑ Train (80%), test (10%), validation (10%) sets formed
- ❑ All images are downsized to a size of 128 x 128 pixels
- ❑ Pixels values (0-255) normalized to 0-1



Build and Tune:

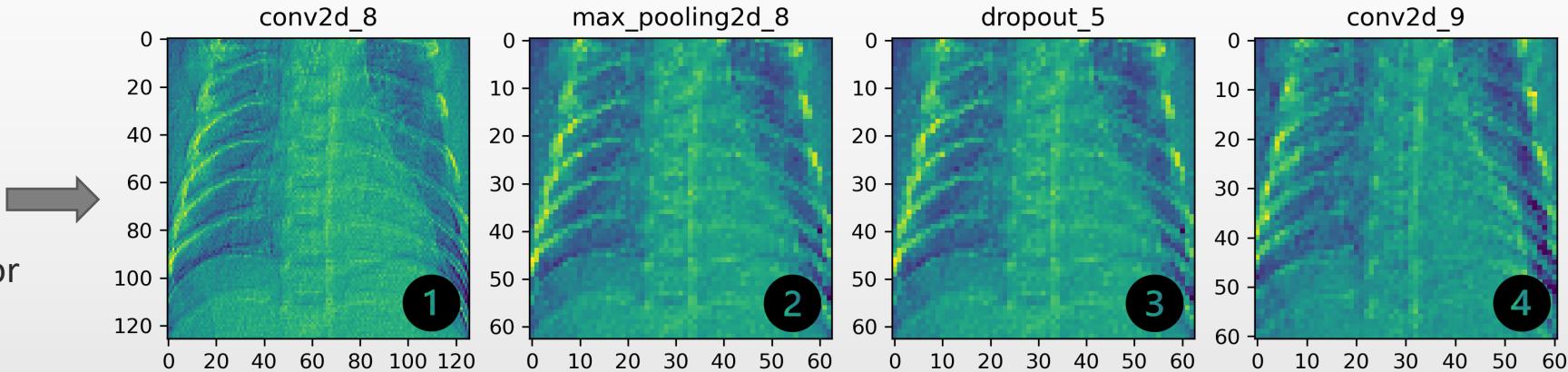
Top Performing Model: Convolutional Neural Network
with dropout regularization and lower learning rate



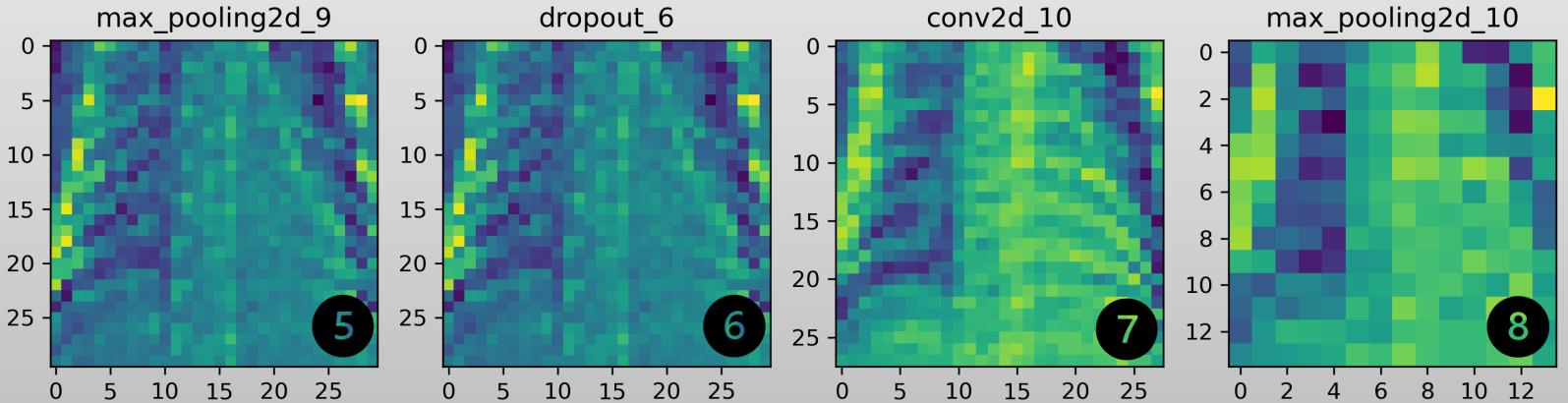
Visualize Features:

The visualization of a single feature map/channel for each of the convolutional layers as they go deeper into the network

Low-Level
features
such as
edges, color



High-Level
more
abstract
features

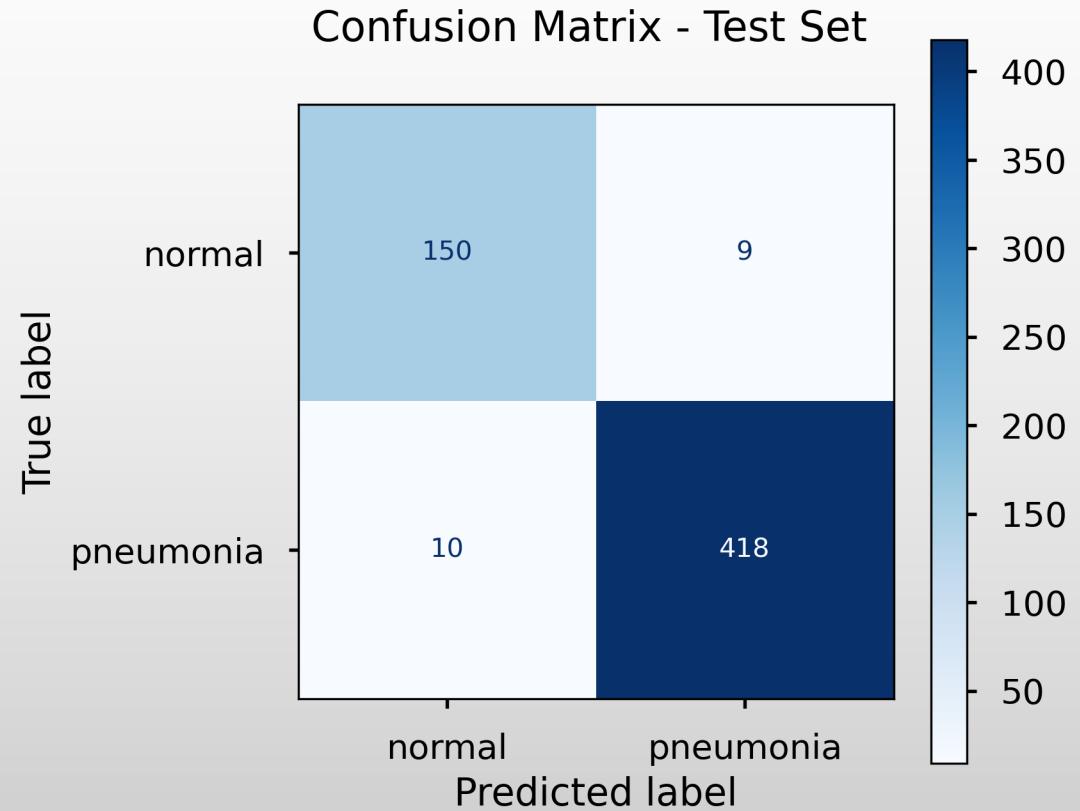


Validate and Evaluate:

Model Performance

	Pneumonia	Normal
Accuracy	97%	
Precision	98%	94%
Recall <i>(True positive rate)</i>	98%	94%
f1-score	98%	94%

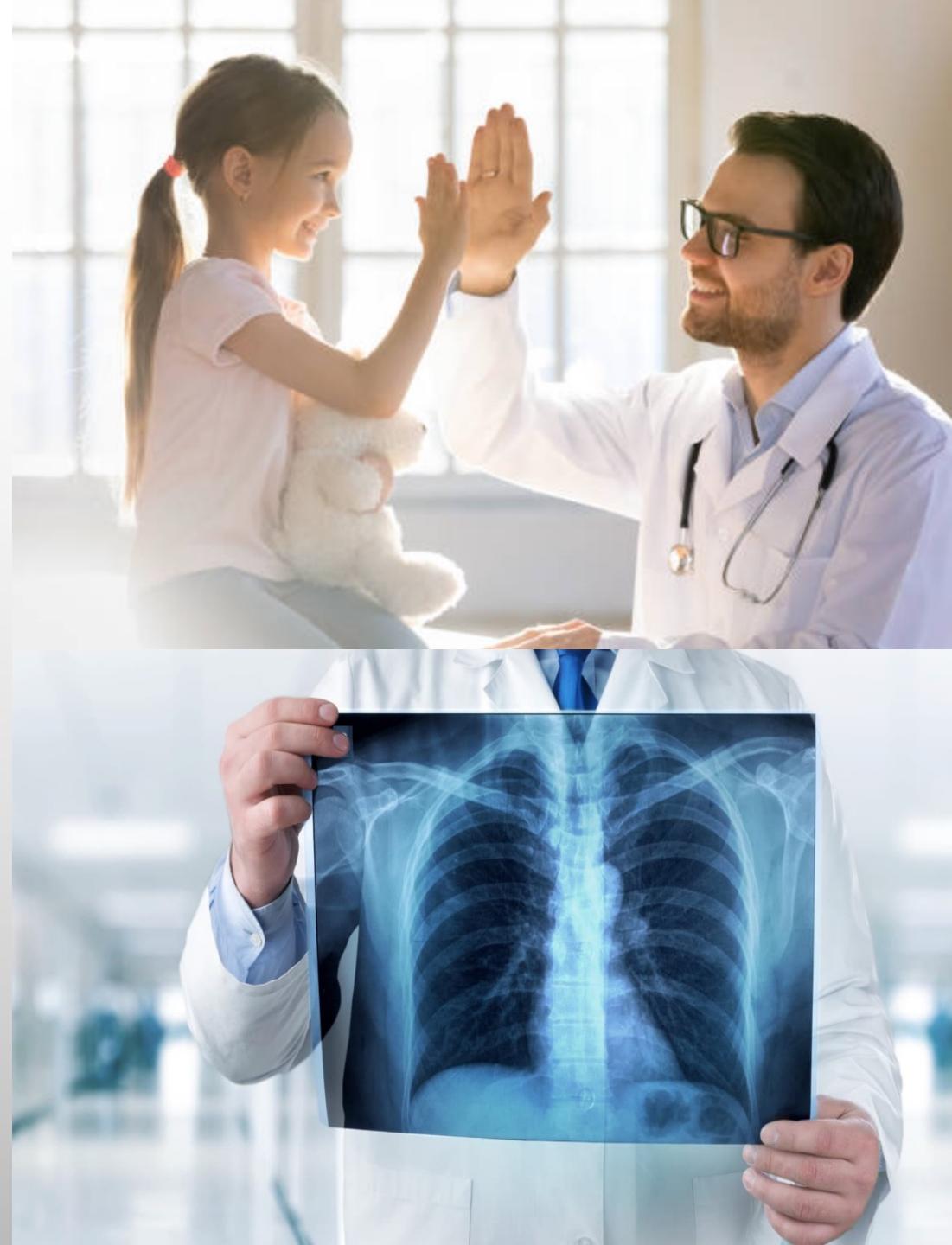
“Very Good” performance in all metrics.



Recommendations:

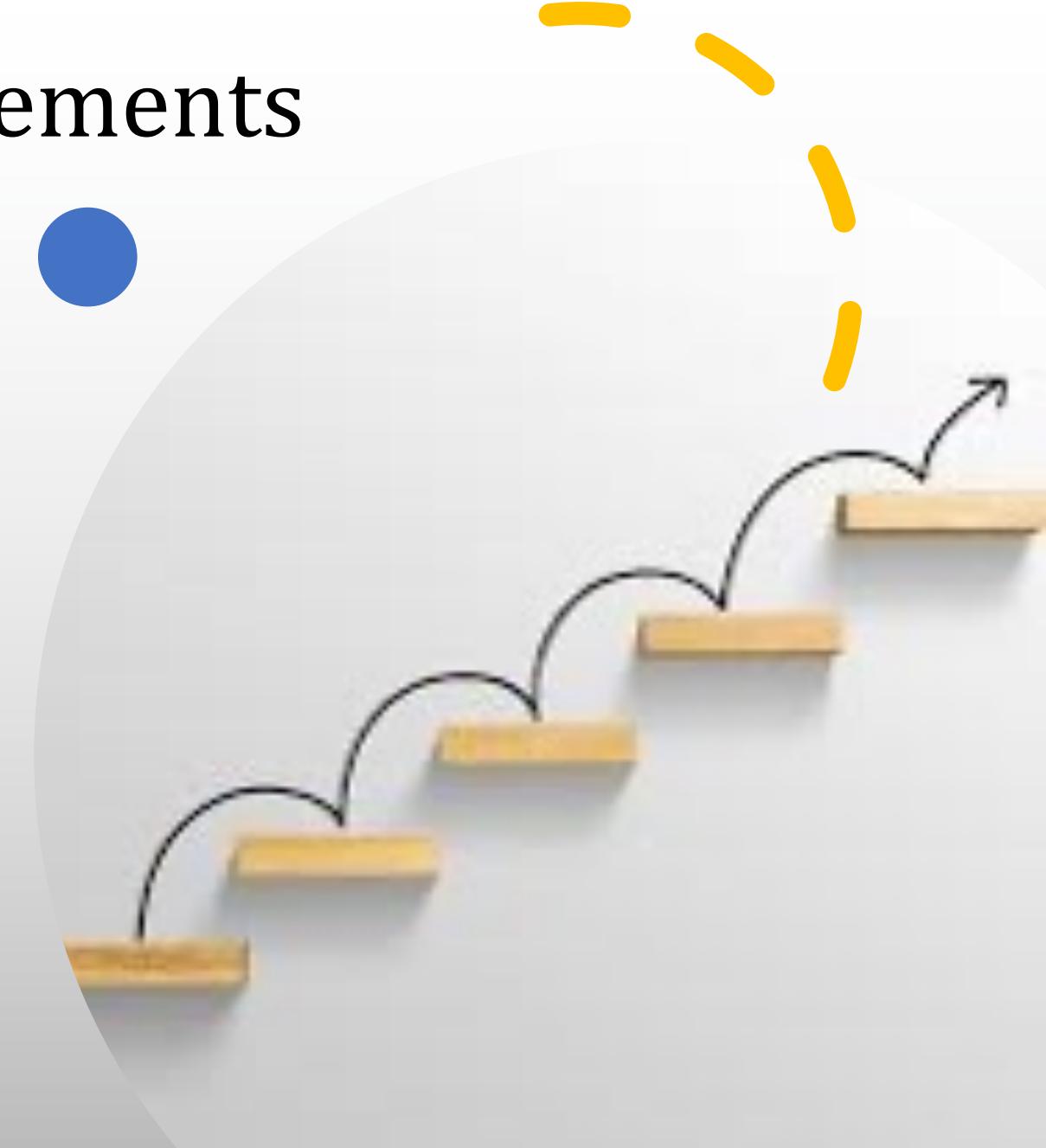
Use of CNN to classify x-ray images

- Stream-line the diagnosing process → quicker return time and greater patient satisfaction.
- Begin the treatment right away for patients classified as high-risk.
- Doctors can allocate more time to go over the images that fall into the grey zone more rigorously, and for more demanding and complex procedures in general.



Limitations and Improvements

- We can use data augmentation methods to increase the size of the training set.
- We can crop the images to exclude the electrodes and letter R from the display which might be negatively affecting the image processing algorithm.
- We could address the class imbalance issue using oversampling techniques.



Thank You

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