X-Ray Image Classification with Deep Learning

Flatiron School Phase 4 Project
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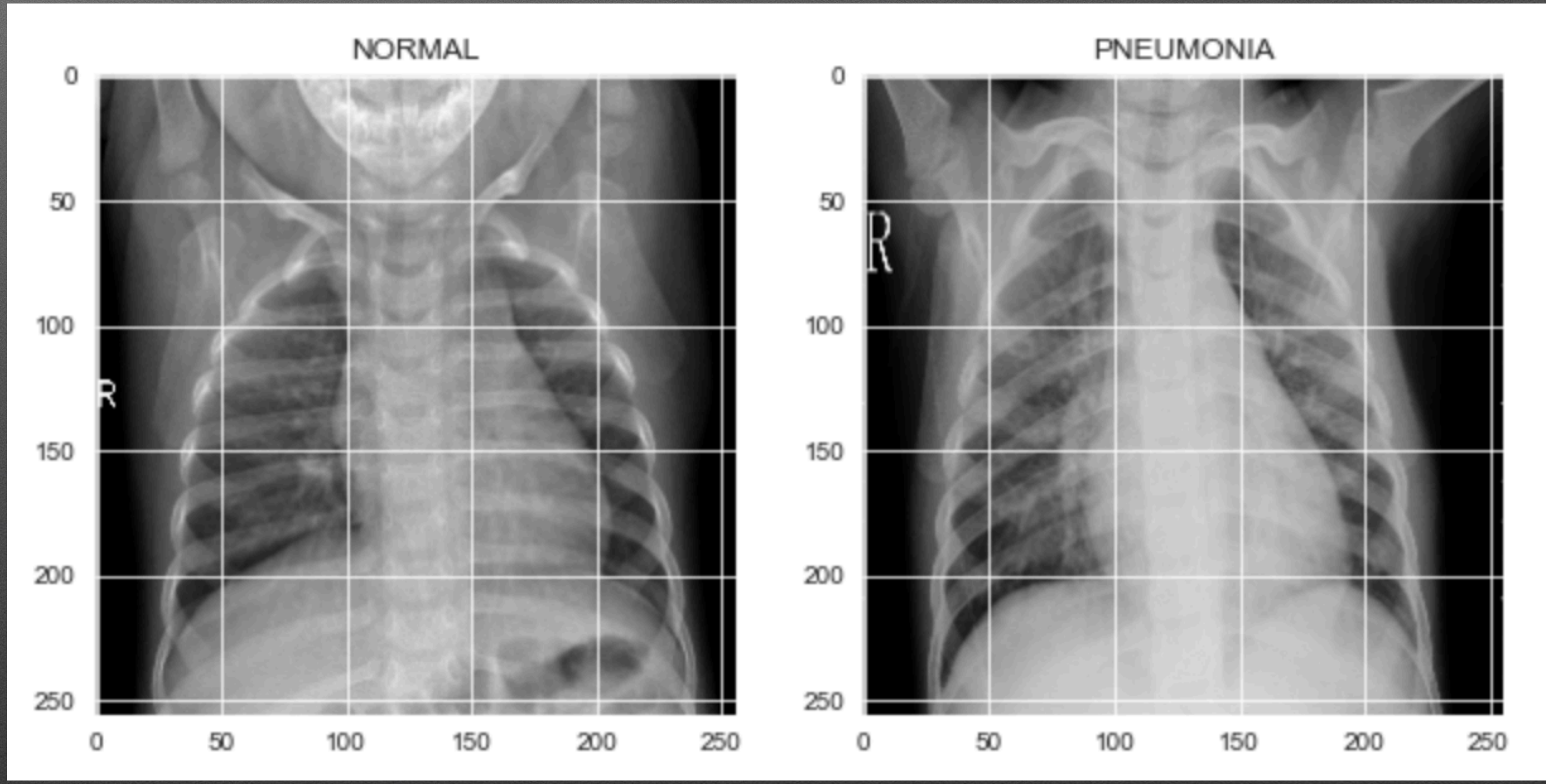
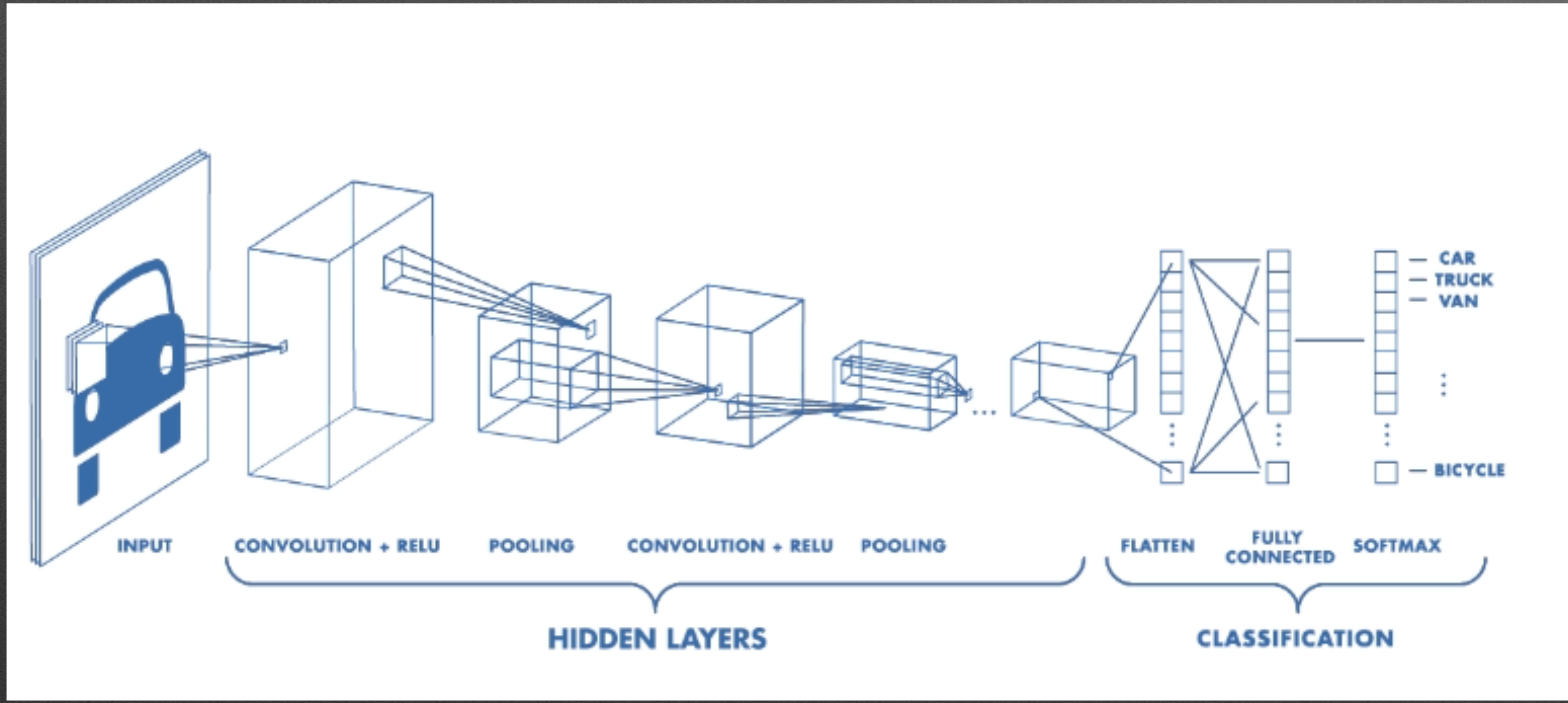
Introduction

- A data analysis and modeling of pediatric chest x-rays for the presence of pneumonia using the ‘Large Dataset of Labeled Optical Coherence Tomography and Chest X-Ray Images’ dataset provided by Mendeley Data
- The goal of this project is to train a neural network to classify x-ray images as containing pneumonia or not containing pneumonia as accurately as possible
- Robust and accurate model could save time, money, and resources for health networks and patients



Methodology

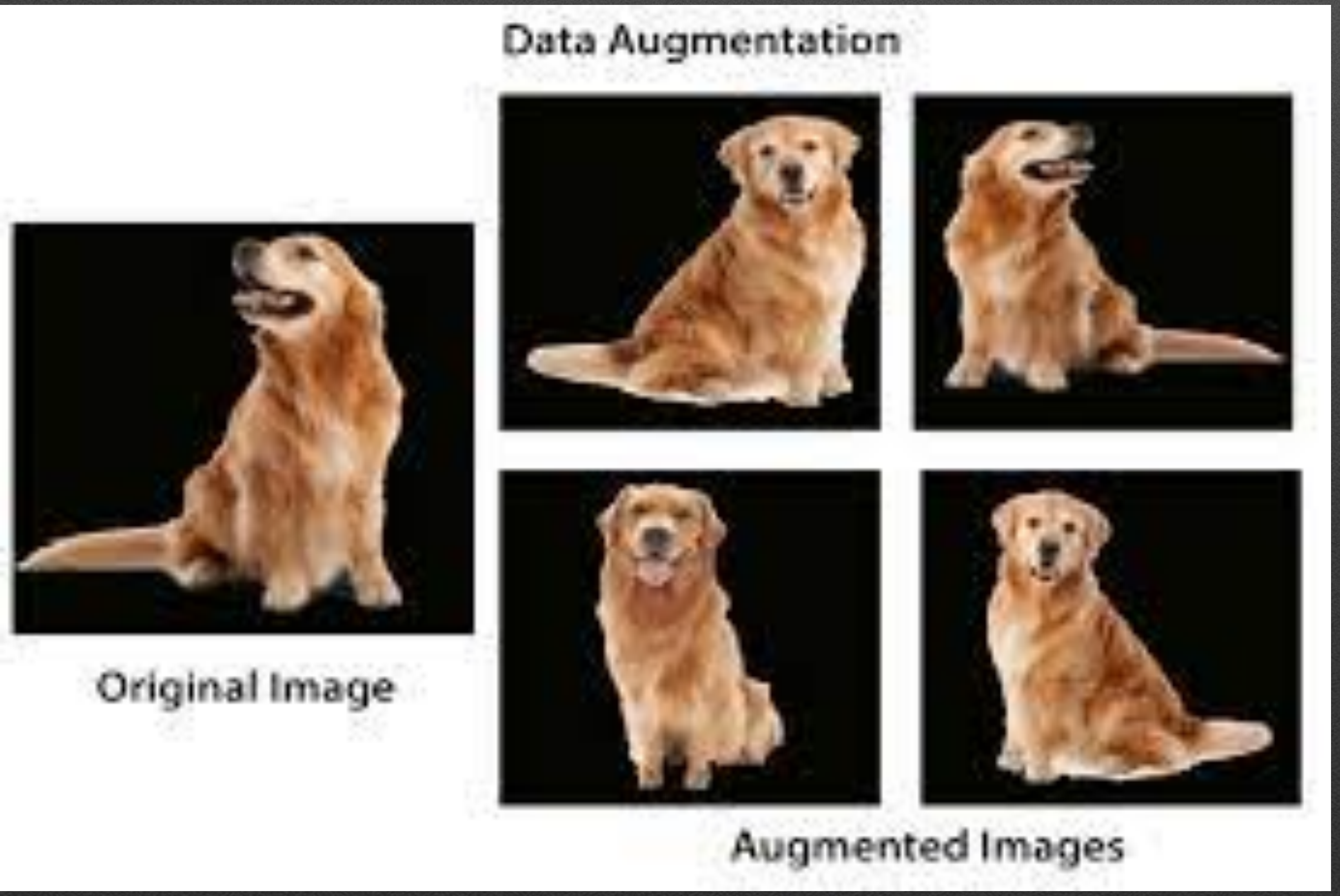


- Prepare data to be modeled
- Explore different CNN modeling architectures
- Iterate through different ranges of data augmentation and hyper-parameter values

EDA & Preprocessing

- Assess dataset split (5,216 training, 16 validation, 624 testing) and label distributions

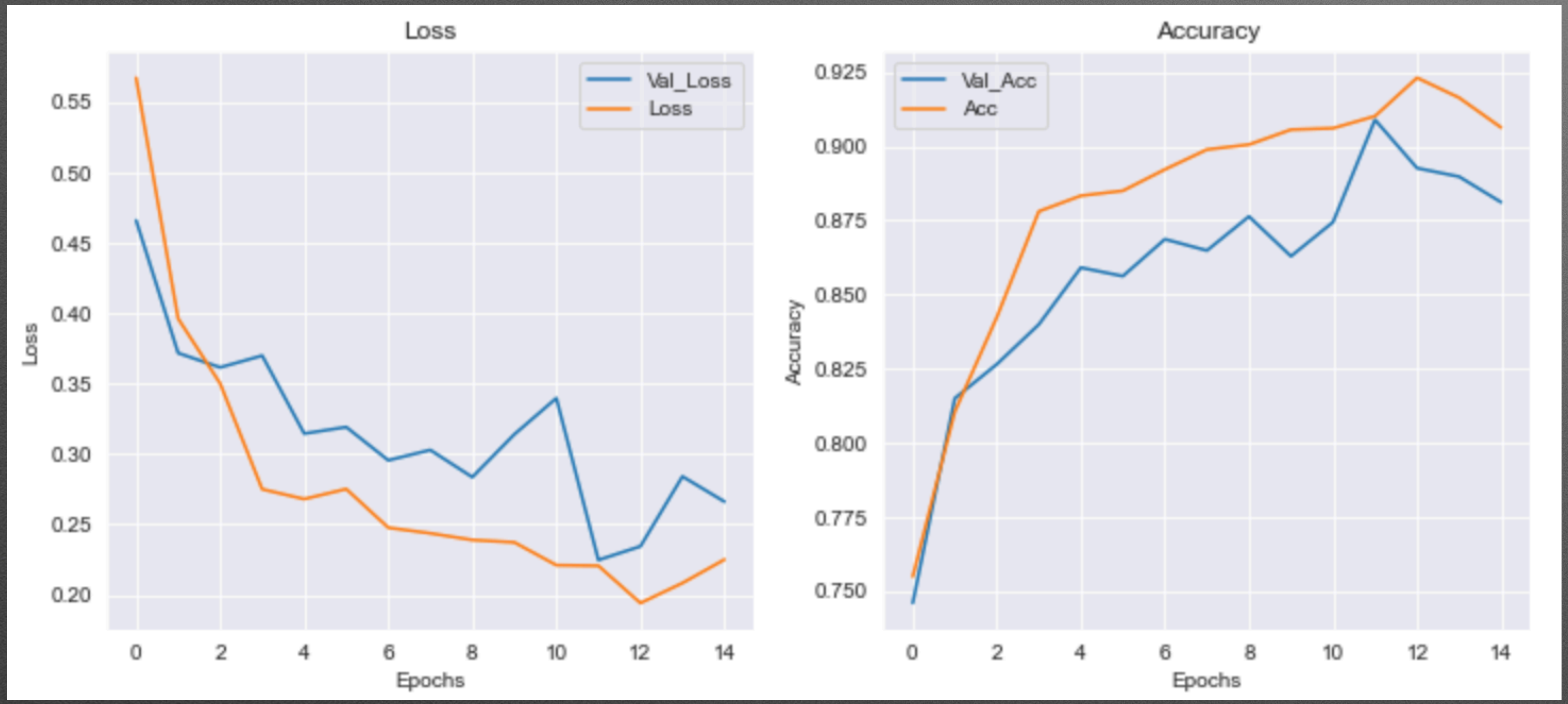
- Found that dataset split and label distribution display class imbalance



- Utilize data augmentation to provide added variance

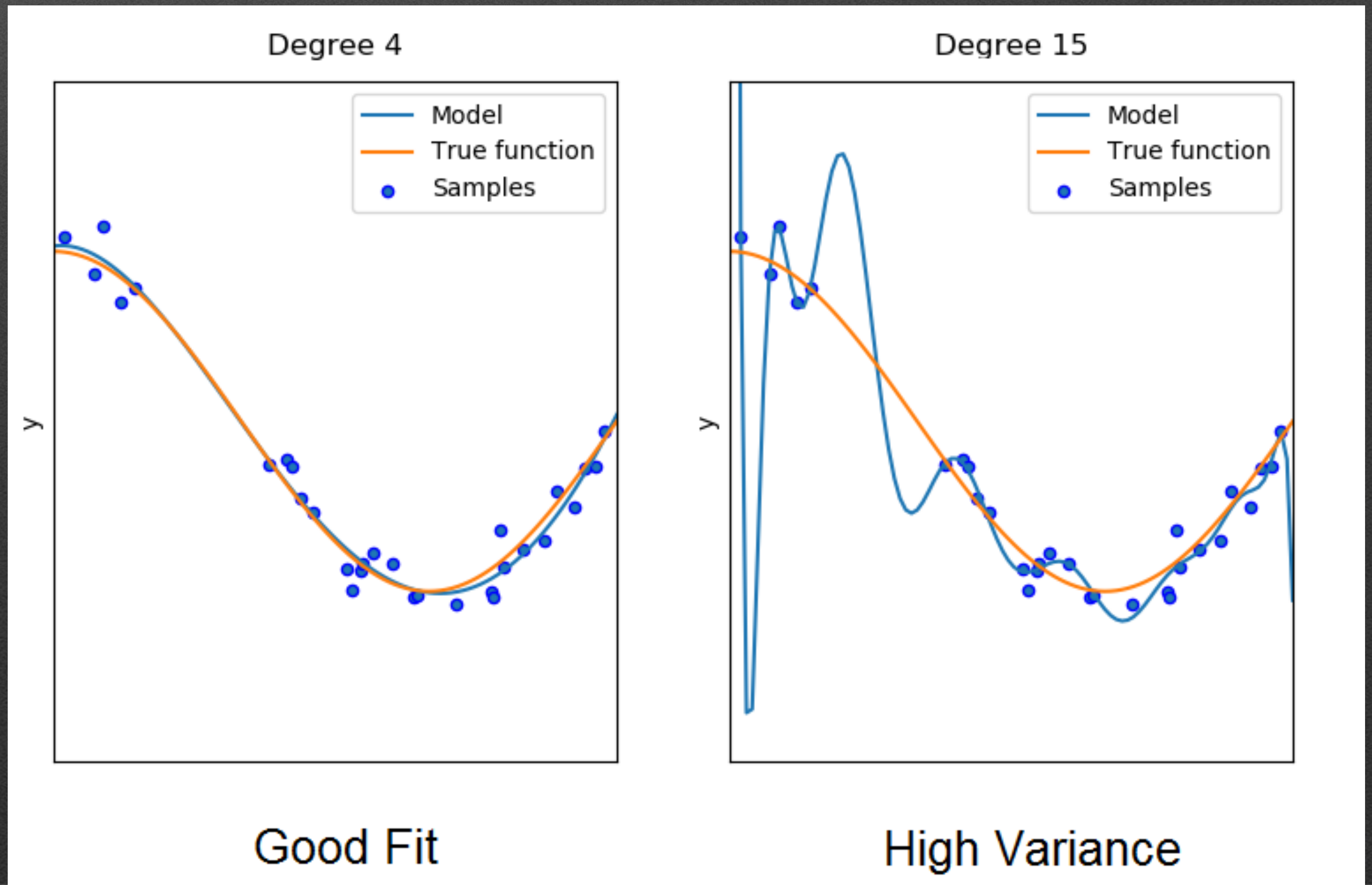
- Data augmentation alters images to give you multiple variations of same image

Modeling



- Model augmented image data iteratively through different values of select hyper-parameters with goal of optimizing accuracy and reducing loss as much as possible

- Explore different regularization techniques and transfer learning in attempt to reduce model over-fitting so data can generalize well to unseen examples



Model Evaluation

- After iterating through many combinations of data augmentation and model configurations, select model with best combination of high accuracy and low loss to evaluate
- Evaluate best model with confusion matrix and classification report
- Best model returned 92% accuracy, 81.2% precision (44 false positives), and 95.5% recall (9 false negatives)

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Confusion Matrix
[[190  44]
 [  9 381]]
Classification Report
              precision    recall  f1-score   support

      NORMAL       0.95      0.81      0.88       234
   PNEUMONIA       0.90      0.98      0.93       390

    accuracy                           0.92       624
   macro avg       0.93      0.89      0.91       624
weighted avg       0.92      0.92      0.91       624
```

Conclusion

- With the ability to correctly identify 95.5% of present pneumonia cases our model did very well, but it did label several images as normal that had pneumonia present (false negative) which could have dire consequences for those patients, so there is still room for improvement

- X-ray assessment can be a costly and time consuming process for radiologists. A machine learning model that saved them time and could improve diagnosis accuracy would benefit them, health care networks, and patients