



Chest X-ray Diagnosis on Pneumonia

Team 43

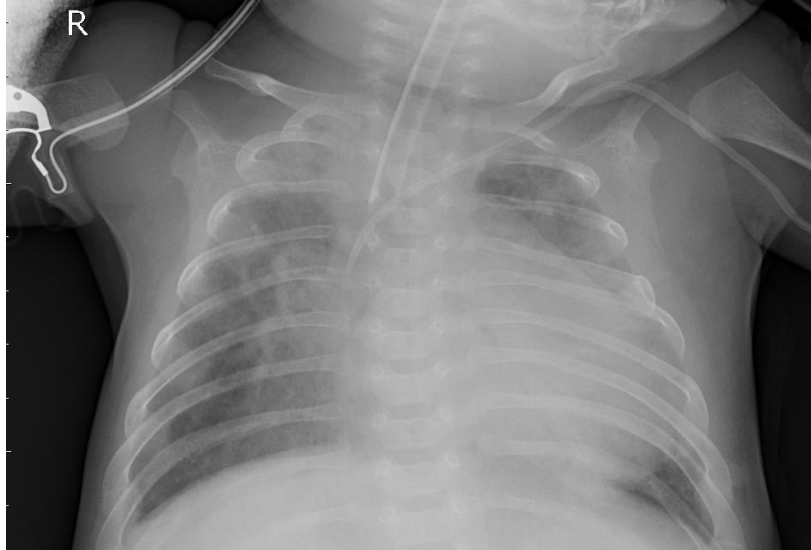
Weixuan Sun 1003803048

Jiawen Li 1002904253

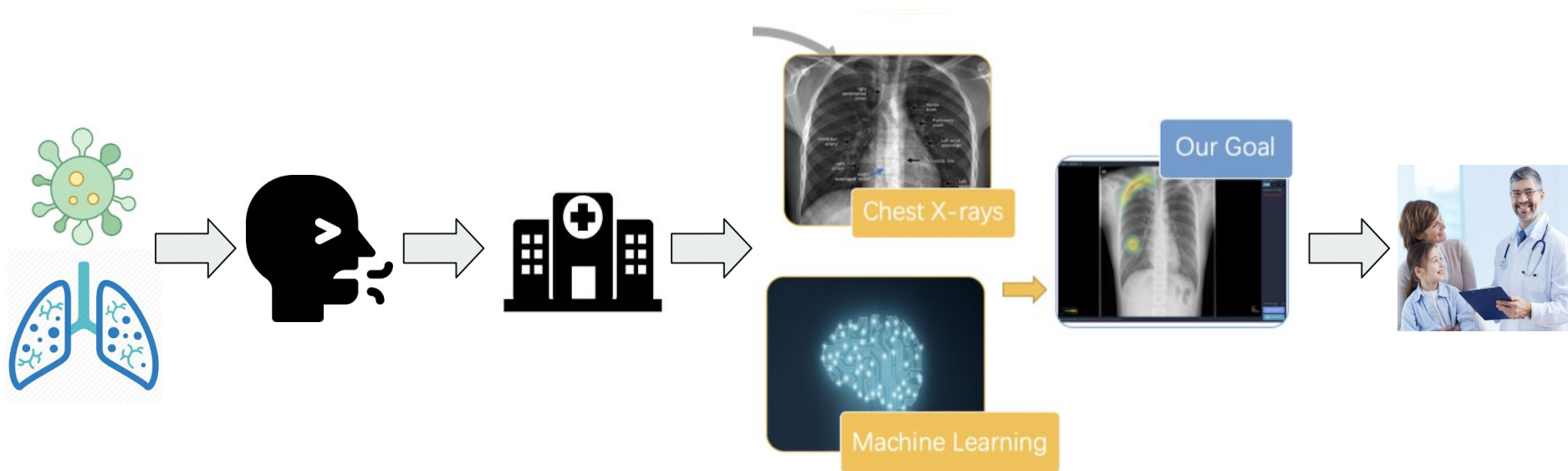
Qiaoyi Yan 1003130774

Yiran Qiu 1004172290

Let's look at some chest x-ray images...



Our Goal

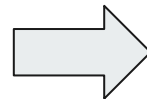
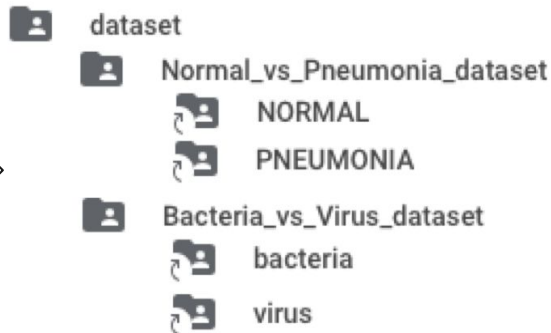
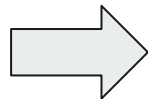


Data Processing - Folder Structure

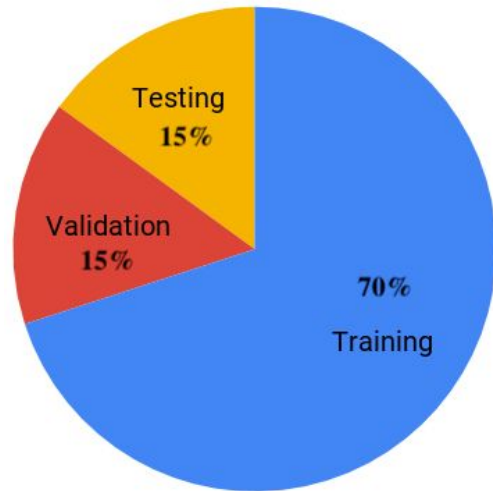
Data Explorer

1.15 GB

- chest_xray
 - test (624 images)
 - NORMAL
 - PNEUMONIA
 - train (5216 images)
 - NORMAL
 - PNEUMONIA
 - val (16 images)
 - NORMAL
 - PNEUMONIA



Dataloader



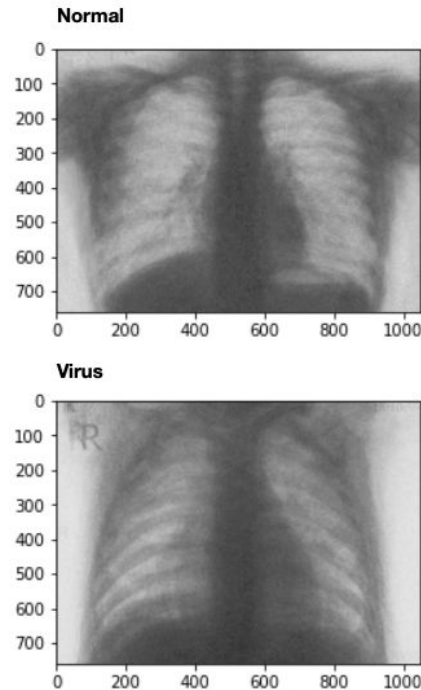
Data Processing - Image Transform



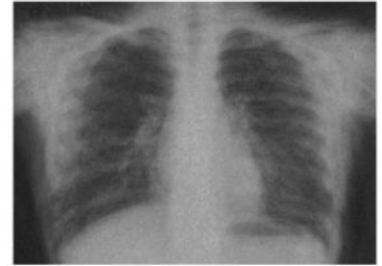
- Convert from RGB (channel = 3) to Grayscale (channel = 1)
- Resize to same dimension (1050 x 760)

Generative Adversarial Network

- Generate artificial training data for imbalanced dataset
 - 96 extra images for normal class
 - 128 extra images for virus class



Normal - Inverted



Virus - Inverted



Design Choice on Model



OR



CNN

Transfer Learning

Normal vs Pneumonia (NP)
validation accuracy:

93%

84%

Bacteria vs Virus (BV)
validation accuracy:

77%

81%

Design Choice on Model

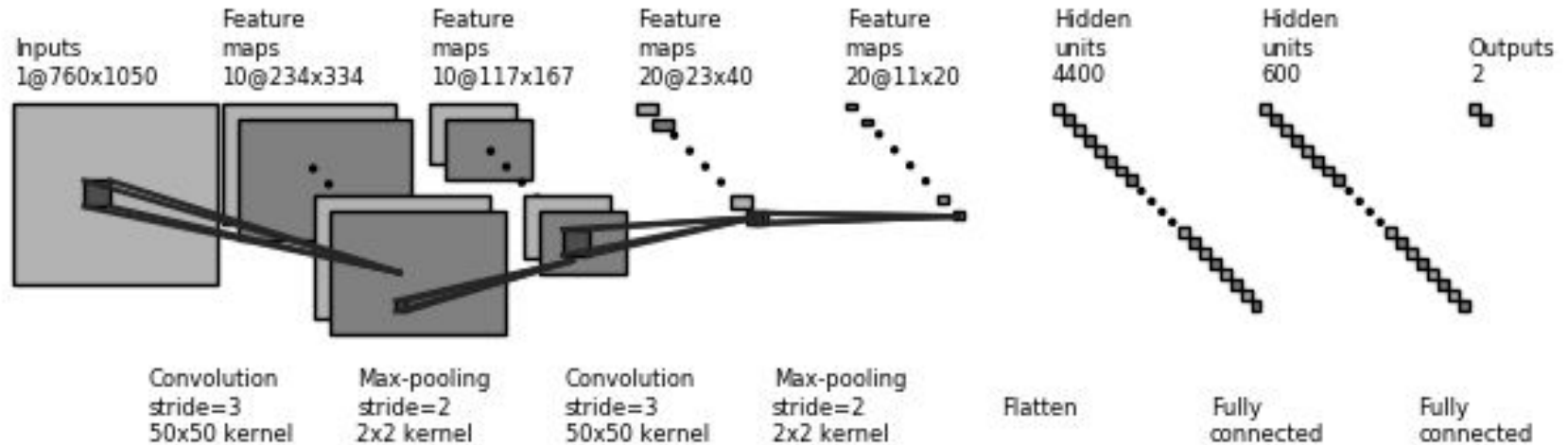


CNN



- Two Binary Convolutional Neural Networks
 - Normal vs Pneumonia classifier
 - Bacteria vs Virus classifier

Normal vs Pneumonia (NP) Classifier



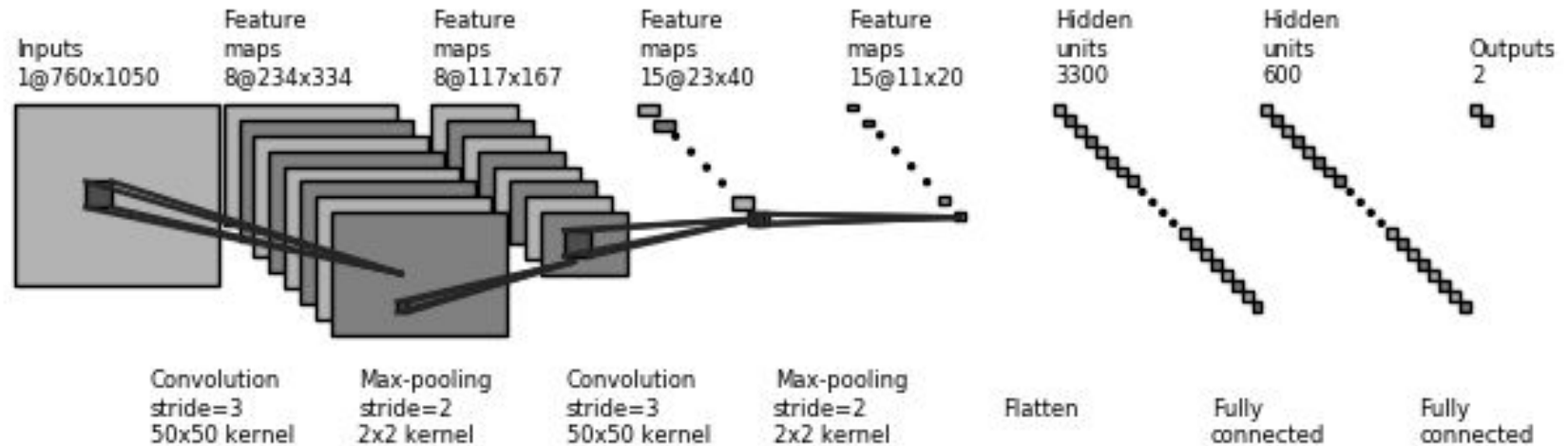
```
=====
Total params: 3,166,832
Trainable params: 3,166,832
Non-trainable params: 0
-----
```

batch_size=64

num_epochs=12

learning_rate=0.0006

Bacteria vs Virus (BV) Classifier



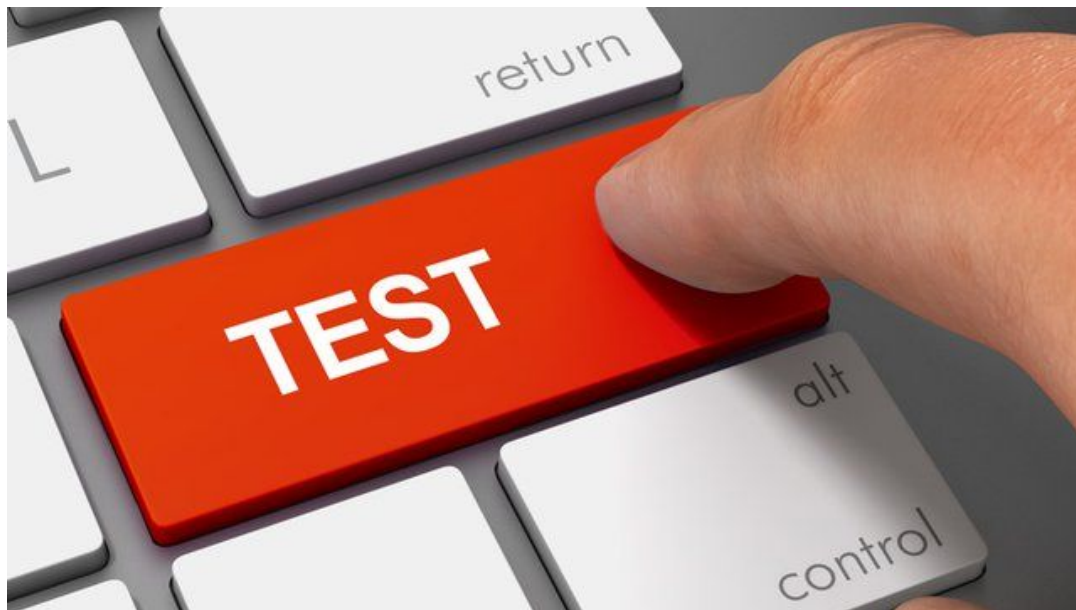
```
=====
Total params: 2,301,825
Trainable params: 2,301,825
Non-trainable params: 0
=====
```

```
batch_size=64
```

```
num_epochs=13
```

```
learning_rate=0.0003
```


Model Evaluations



Results - NP Model

92.8%

Testing accuracy

Normal VS Pneumonia Binary Classifier with
879 testing images

- True Positive Rate = 0.841
- **True Negative Rate = 0.967**
- False Positive Rate = 0.037
- False Negative Rate = 0.153

*Treating pneumonia as positive

Label: NORMAL
Predicted: NORMAL



Label: PNEUMONIA
Predicted: PNEUMONIA



Results - BV Model

75.5%

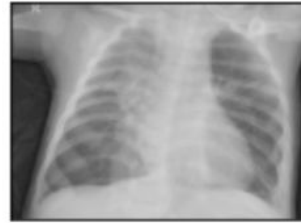
Testing accuracy

Bacterial VS Virus Pneumonia Binary
Classifier with 634 testing images

- **True Positive Rate = 0.833**
- True Negative Rate = 0.6
- False Positive Rate = 0.4
- False Negative Rate = 0.167

*Treating Virus pneumonia as positive

Label: bacteria
Predicted:bacteria



Label: virus
Predicted:virus



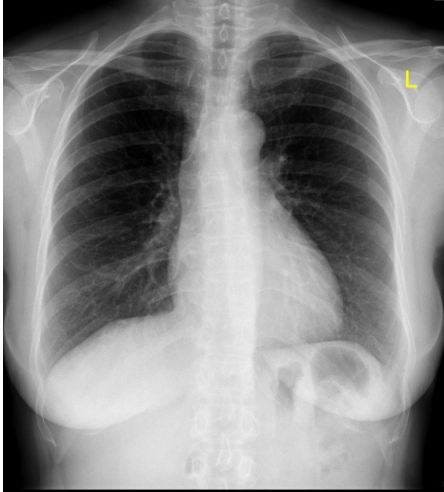
Label: virus
Predicted:bacteria



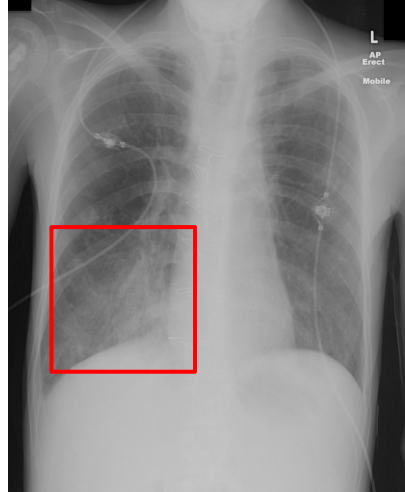
Label: bacteria
Predicted:virus



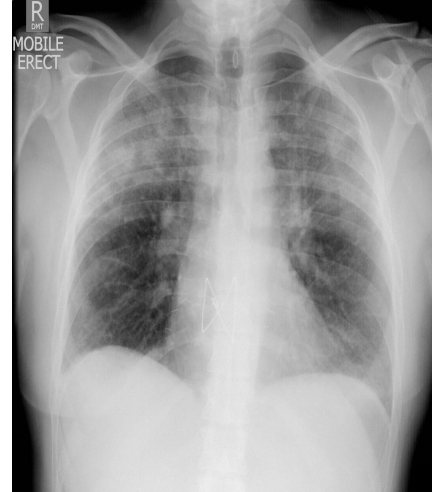
Testing on random cases from Radiopaedia



Normal



Bacterial
Pneumonia



Virus
Pneumonia



COVID-19
Pneumonia

Discussions



- NP model performs very well 92.8% 😊

- BV model could still improve 75.5% 😞

40% virus class images are misclassified

How to improve BV model accuracy?

- Transfer learning
- High quality X-ray image dataset

Thanks for watching!

