COVID-19 alike Viral *PNEUMONIA* DiAgNosis via Chest X-ray Images

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PNEUMONIA OVERVIEW

An infection of the air sacs in one or both the lungs.

- Very common (**More than 3 million cases per year in US**)
- Transmitted through respiratory droplets
- May be preventable by vaccine
- Treatment from medical professional advised
- Often requires lab test or **imaging**
- Can last several weeks or months
- Can be dangerous or life threatening if untreated
- Urgent medical attention recommended

CHEST X-RAY IMAGE DIAGNOSIS

- A chest X-ray test is a very common, non-invasive radiology test that produces an image of the chest and the internal organs.
- **Chest x ray to look for inflammation in your lungs**.
- A chest x ray is **the best test** for diagnosing pneumonia. This test helps your doctor diagnose pneumonia and determine the extent and location of the infection.
- However, it can't tell your doctor what kind of germ is causing the pneumonia.

Model: "sequential"

Layer (type)	Output Shape	Param #
dense (Dense)	(None, 20)	1350020
dense_1 (Dense)	(None, 7)	147
dense_2 (Dense)	(None, 5)	40
dense_3 (Dense)	(None, 1)	6

Total params: 1,350,213
Trainable params: 1,350,213
Non-trainable params: 0

CHEST X-RAY IMAGE CLASSIFIER - baseline model

Densely Connected Network	Loss	Accuracy
Training	0.2137	0.9311
Testing	0.1858	0.9470

CHEST X-RAY IMAGE CLASSIFIER - CNN model

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 148, 148, 32)      896
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 74, 74, 32)        0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 72, 72, 64)        18496
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 36, 36, 64)        0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 34, 34, 128)       73856
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 17, 17, 128)       0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 15, 15, 128)       147584
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 7, 7, 128)         0
_________________________________________________________________
flatten (Flatten)            (None, 6272)              0
_________________________________________________________________
dense_4 (Dense)              (None, 512)               3211776
_________________________________________________________________
dense_5 (Dense)              (None, 1)                 513
=================================================================
Total params: 3,453,121
Trainable params: 3,453,121
Non-trainable params: 0
_________________________________________________________________
```

Convolutional Neural Network	Loss	Accuracy
Training	0.0706	0.9755
Testing	0.0801	0.9744

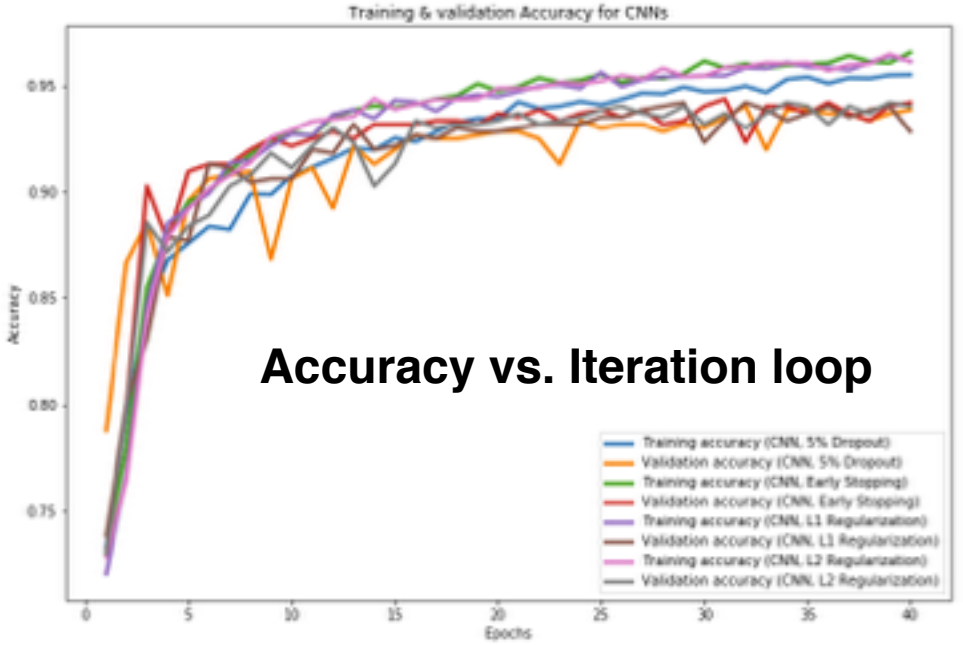
CHEST X-RAY IMAGE CLASSIFIER

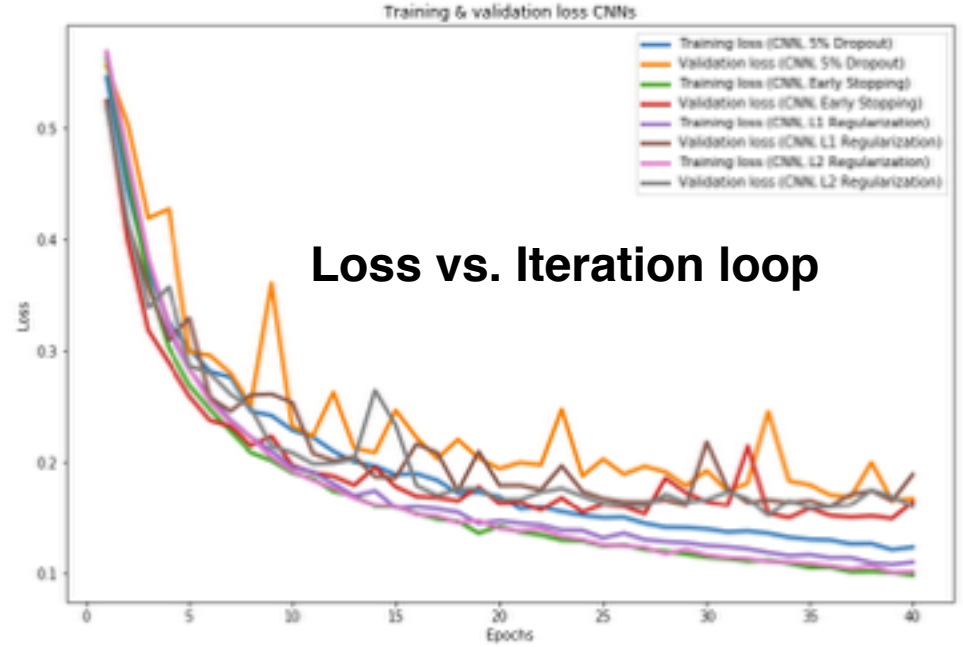
Over-fitting solutions:

(1) regularization approaches

(2) dropout

(3) pre-trained model w/ architecture adjustment and/or fine tuning



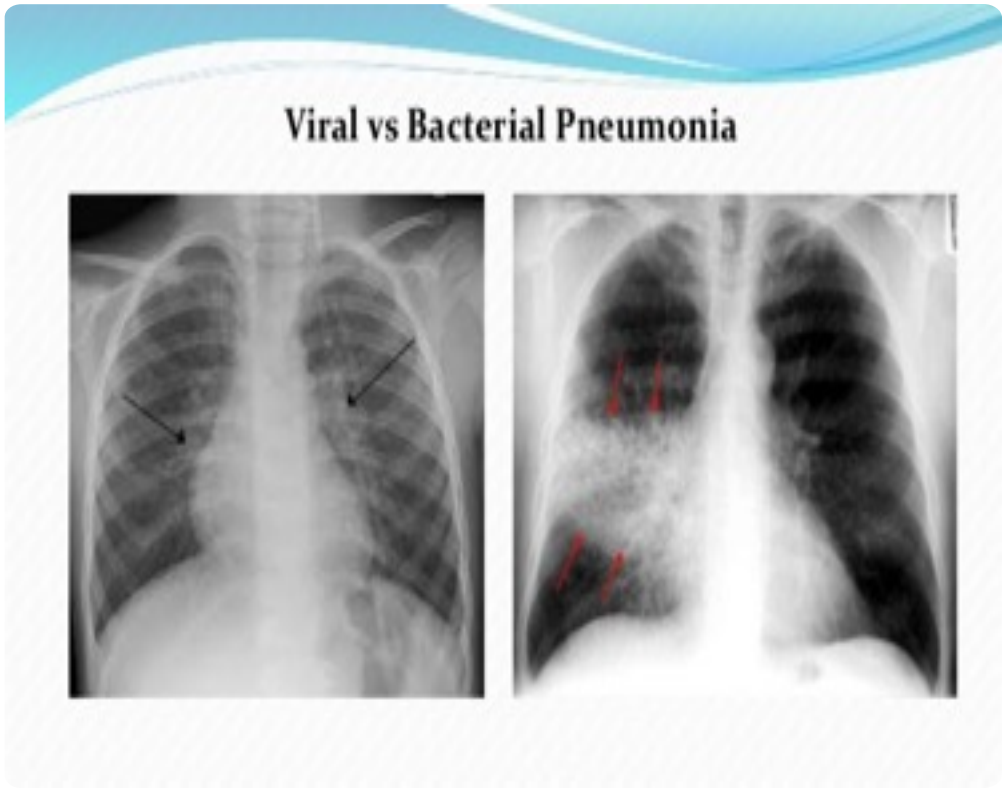


Recommendation

- **Follow-up chest radiographs are frequently recommended.** Follow-up imaging of radiographically suspected pneumonia leads to a small number of new diagnoses of malignancy and important nonmalignant diseases, which may alter patient management.

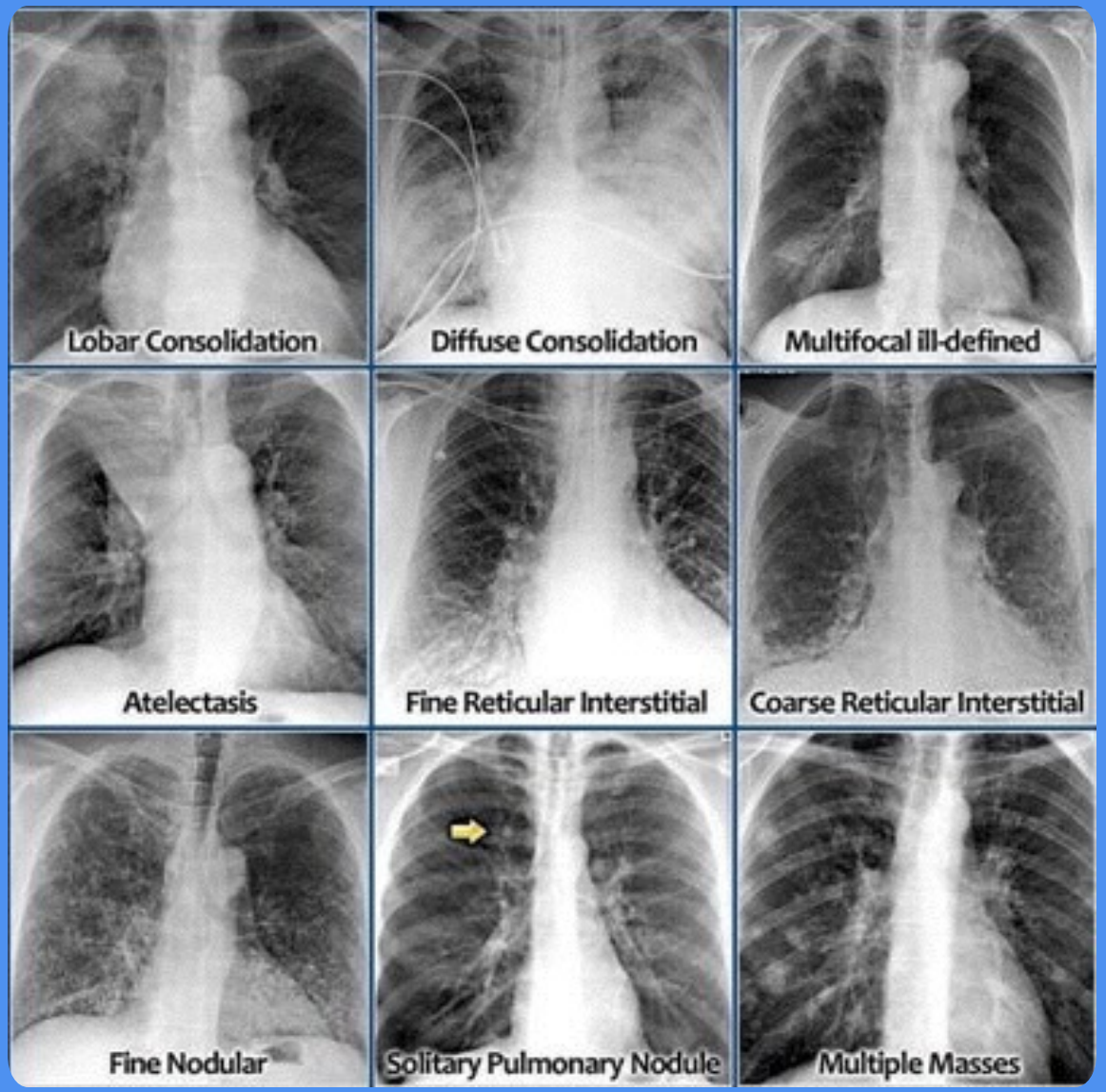
- **Distinguishing viral pneumonia from bacterial pneumonia is difficult.** In some cases, they could co-exist, increasing the chance of a more unfortunate outcome. The clinician should be aware that the coexistence of viral and bacterial pneumonia increases the risk of death. Viral pneumonia is a common complication of influenza-like illnesses and is a complication of SARS-COV-2. Viral pneumonia may clear up on its own; however, when severe, it can be life-threatening. Viruses are generally not as common as some bacteria. However, as well as being a primary pathogen, viruses can be a co-pathogen with bacteria, particularly in those with severe illness requiring admission to ICU and in ventilator-associated pneumonia.

- **A severe complication of COVID-19 is viral pneumonia.** Coronavirus has also been shown to occur with pneumonia. Most people who get COVID-19 have mild or moderate symptoms like coughing, a fever, and shortness of breath. But some who catch the new coronavirus get severe pneumonia in both lungs. COVID-19 pneumonia is a serious illness that can be deadly.



Future Work 1:

develop a classifier used to separate viral from bacterial pneumonia

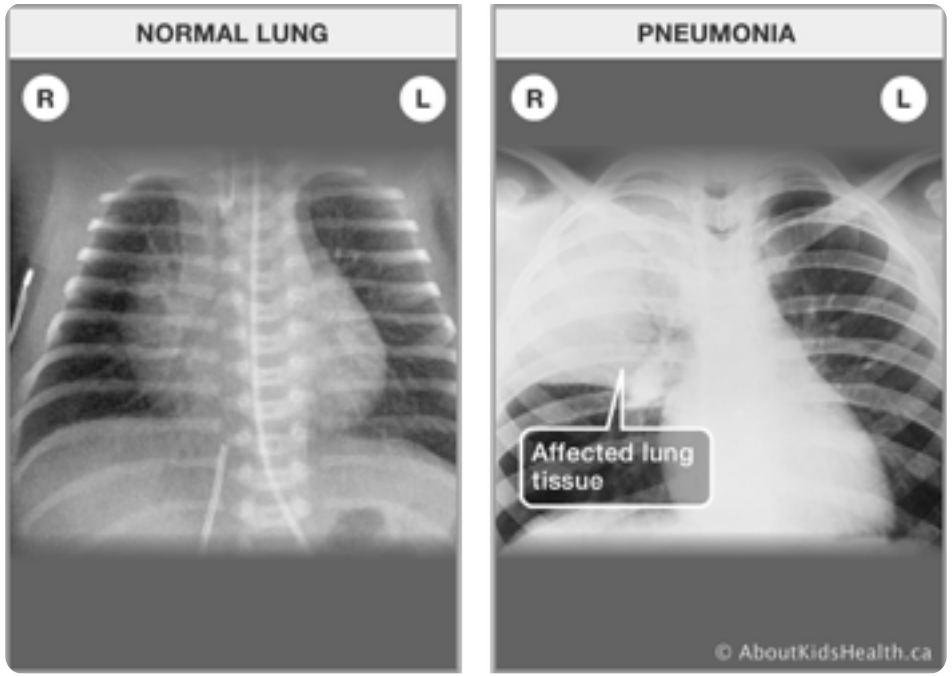


Future Work 2:

develop a **translator** used to interpret pictures and generate captions as printed on every single X-ray image

Future Work 3:

develop a **label generator** used to generate more images which shows the sign of pneumonia



Future Work 4:

develop an frame maker used to align every X-ray image for the convenience of handwritten labelling

Thank you!

Appendix attached as follows

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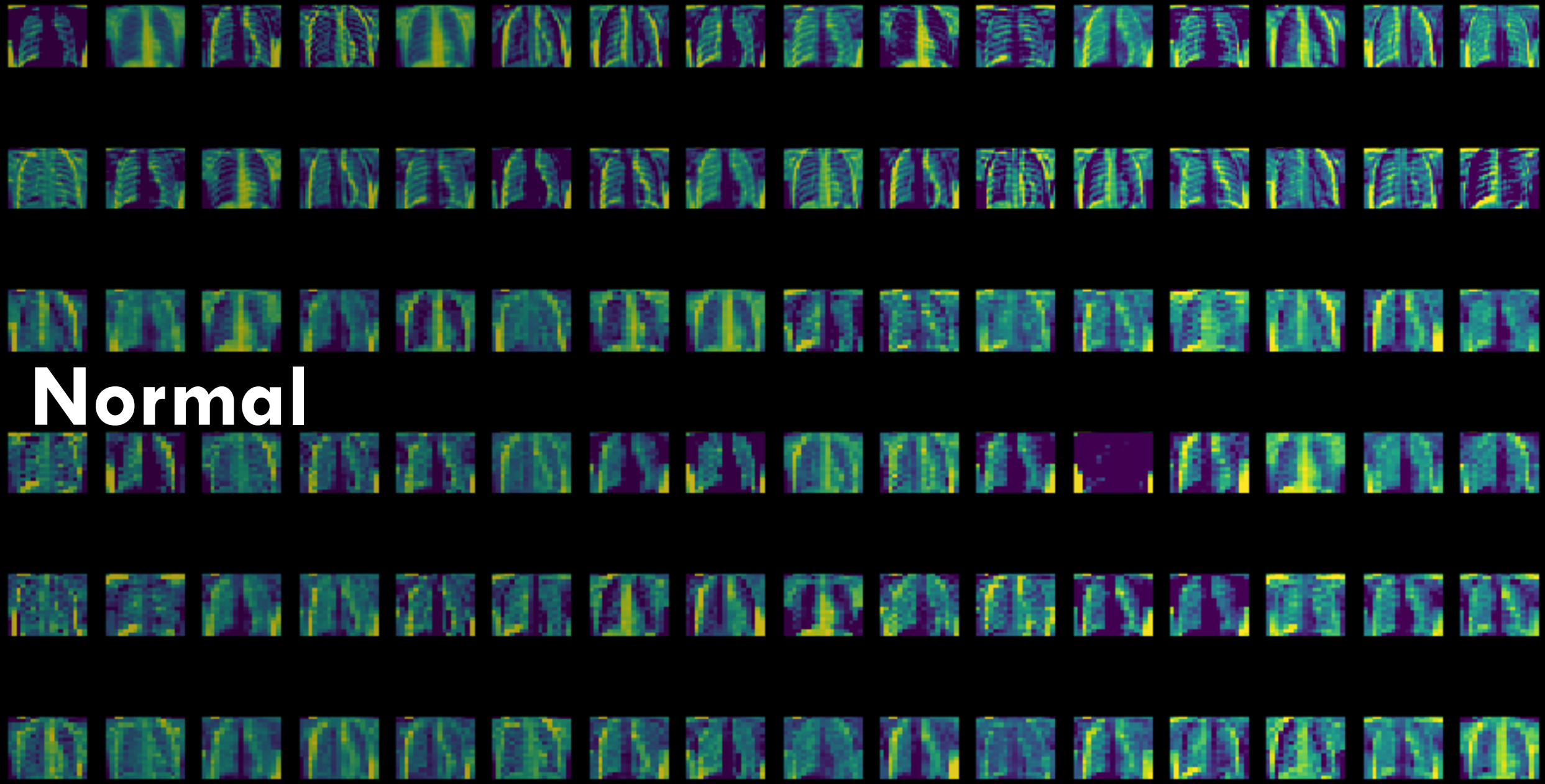
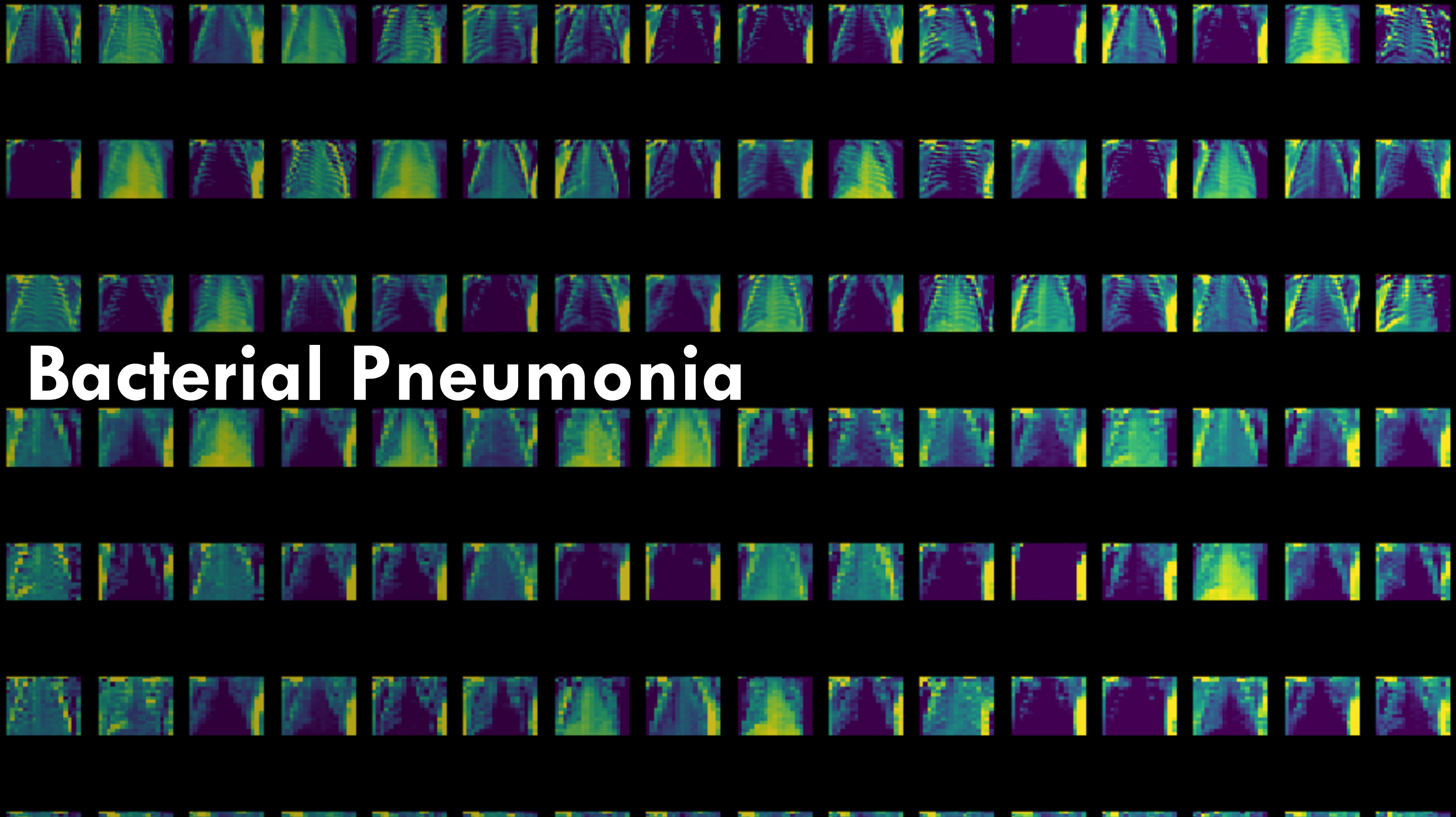
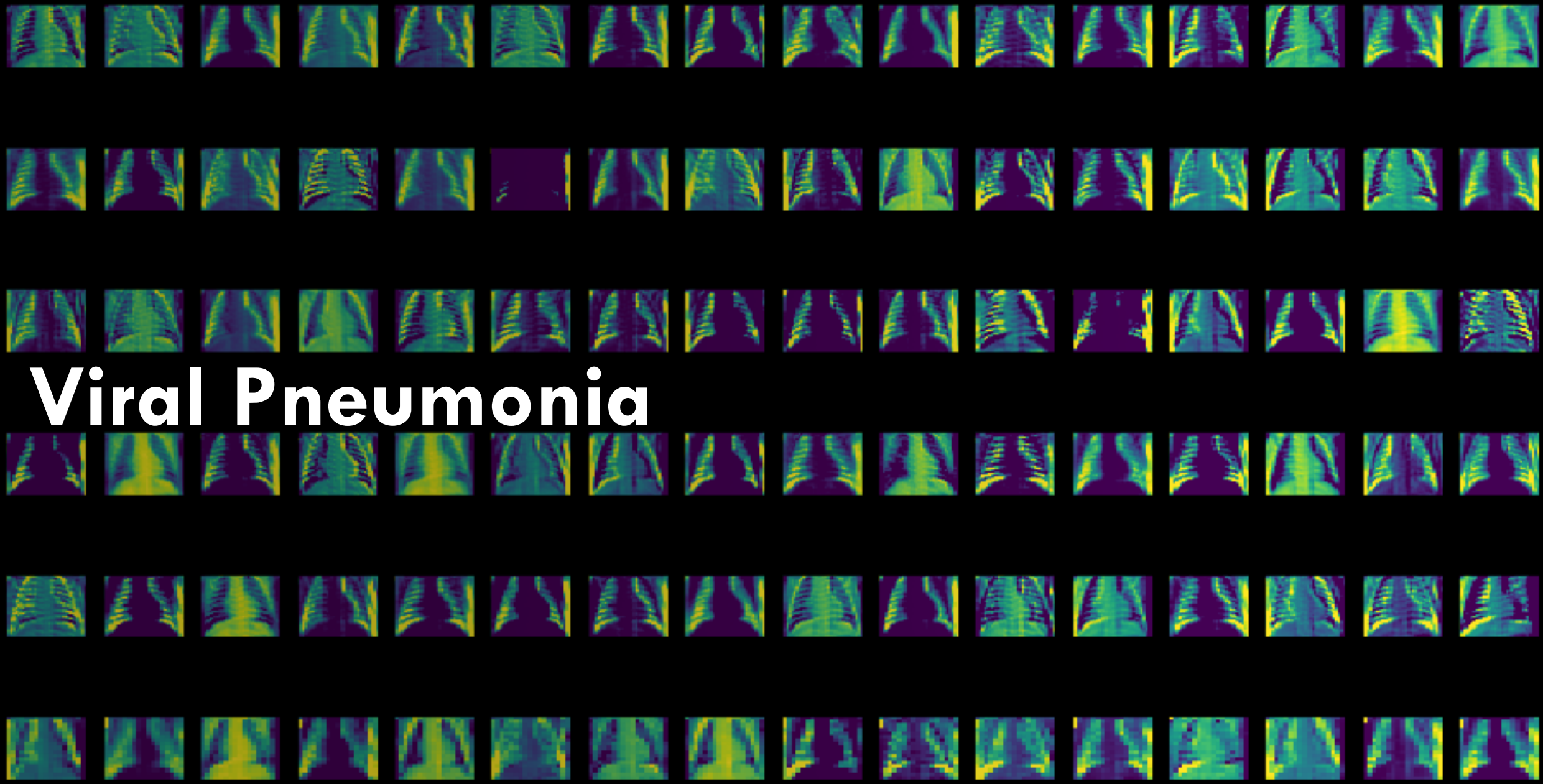
Appendix


Normal


Bacterial Pneumonia


Viral Pneumonia