

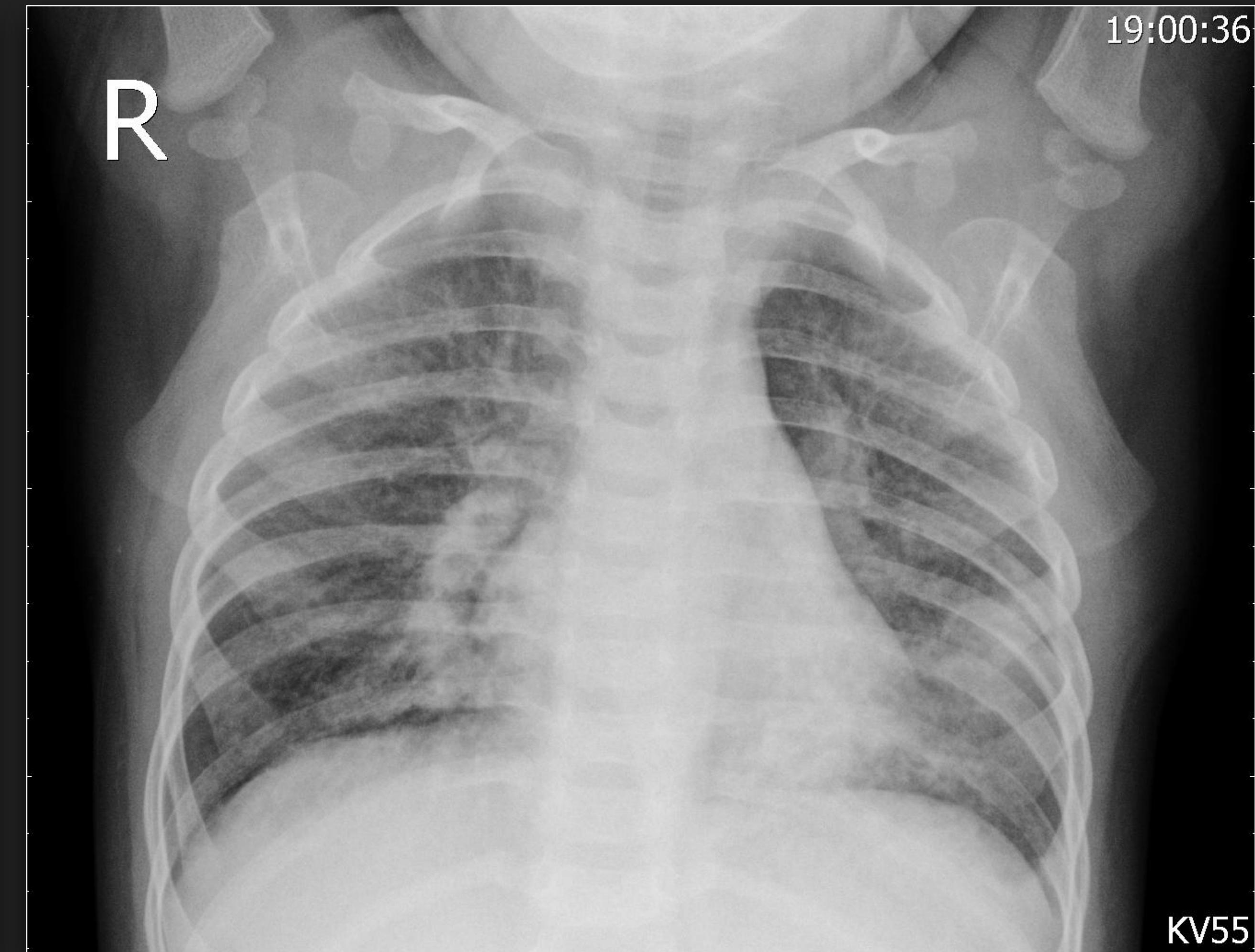
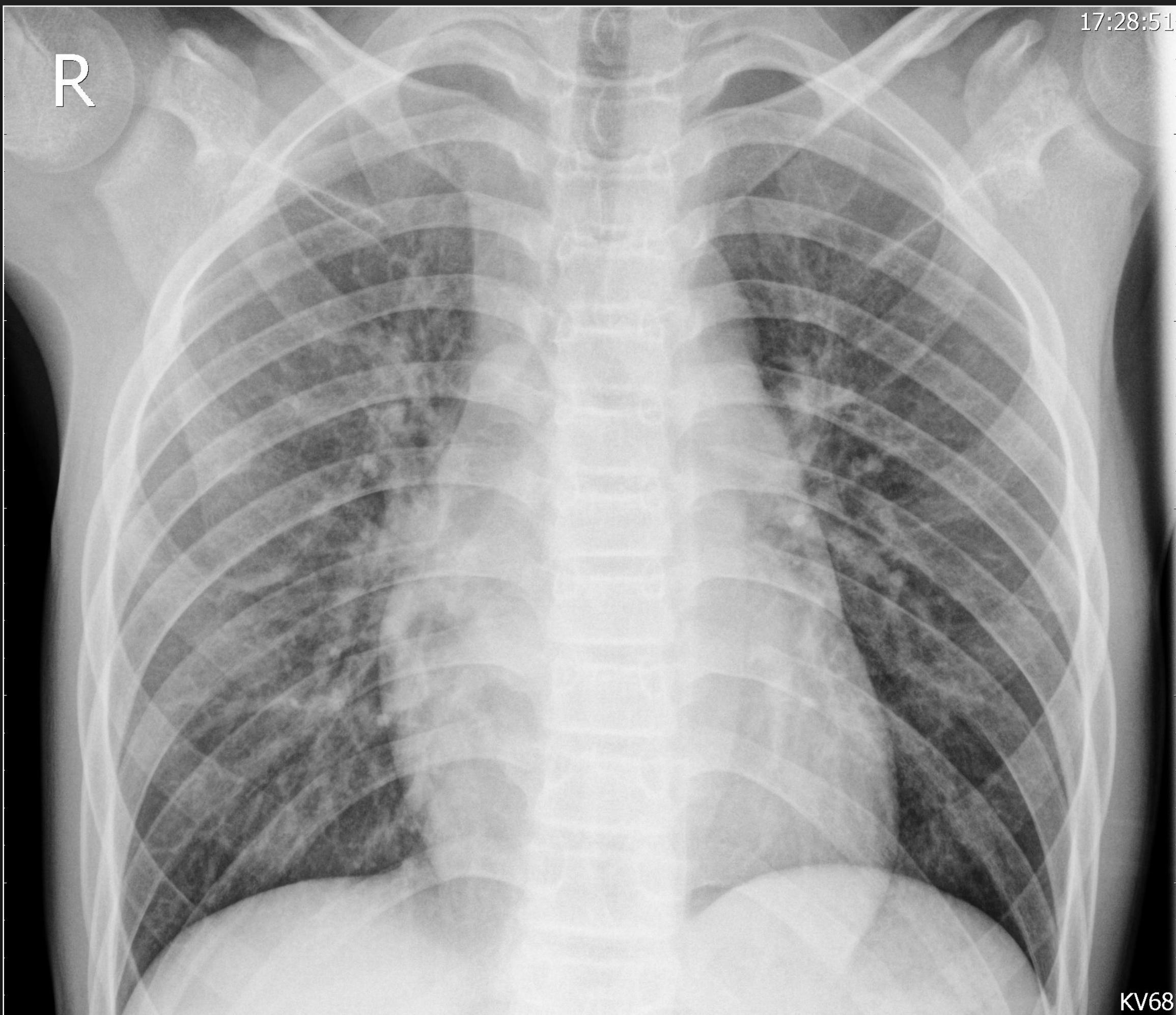
Chest X-Ray Classification

Brent Thayer

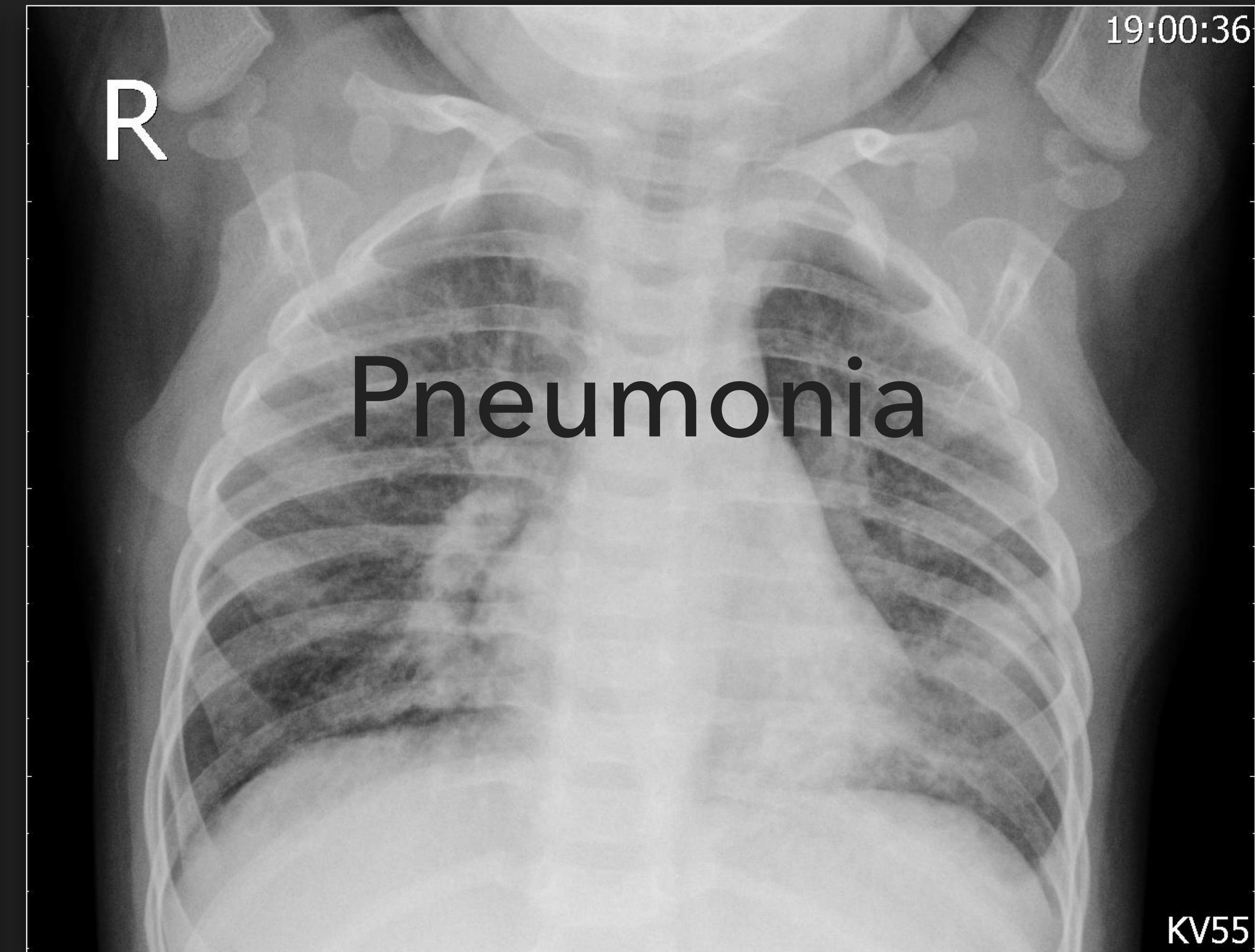
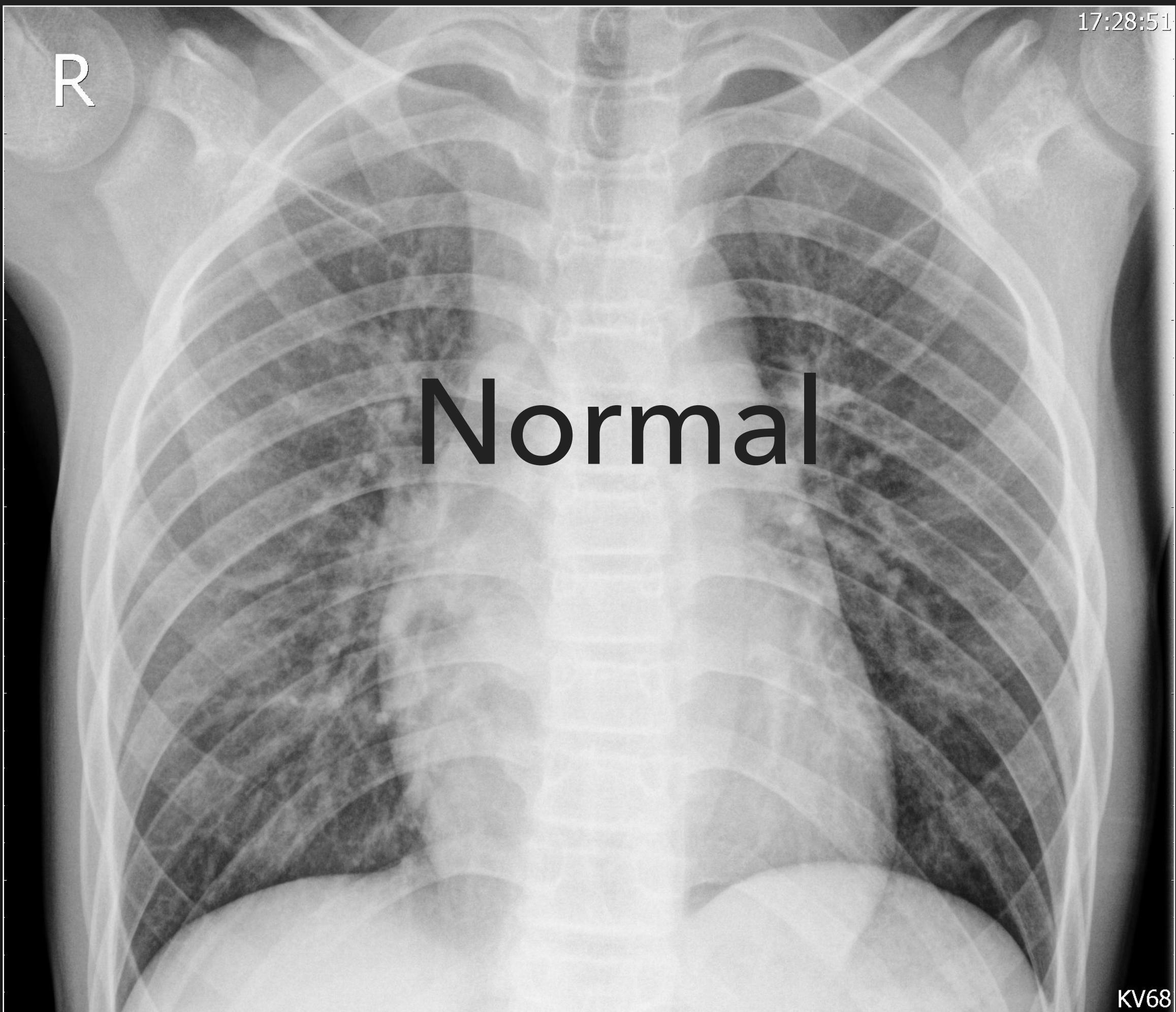


Is it possible to train a model to classify pneumonia from a chest X-ray?

An X-ray allows a radiologist to see the lungs, heart and blood vessels. When interpreting the X-ray, the radiologist will look for white spots in the lungs (called infiltrates) that identify an infection.

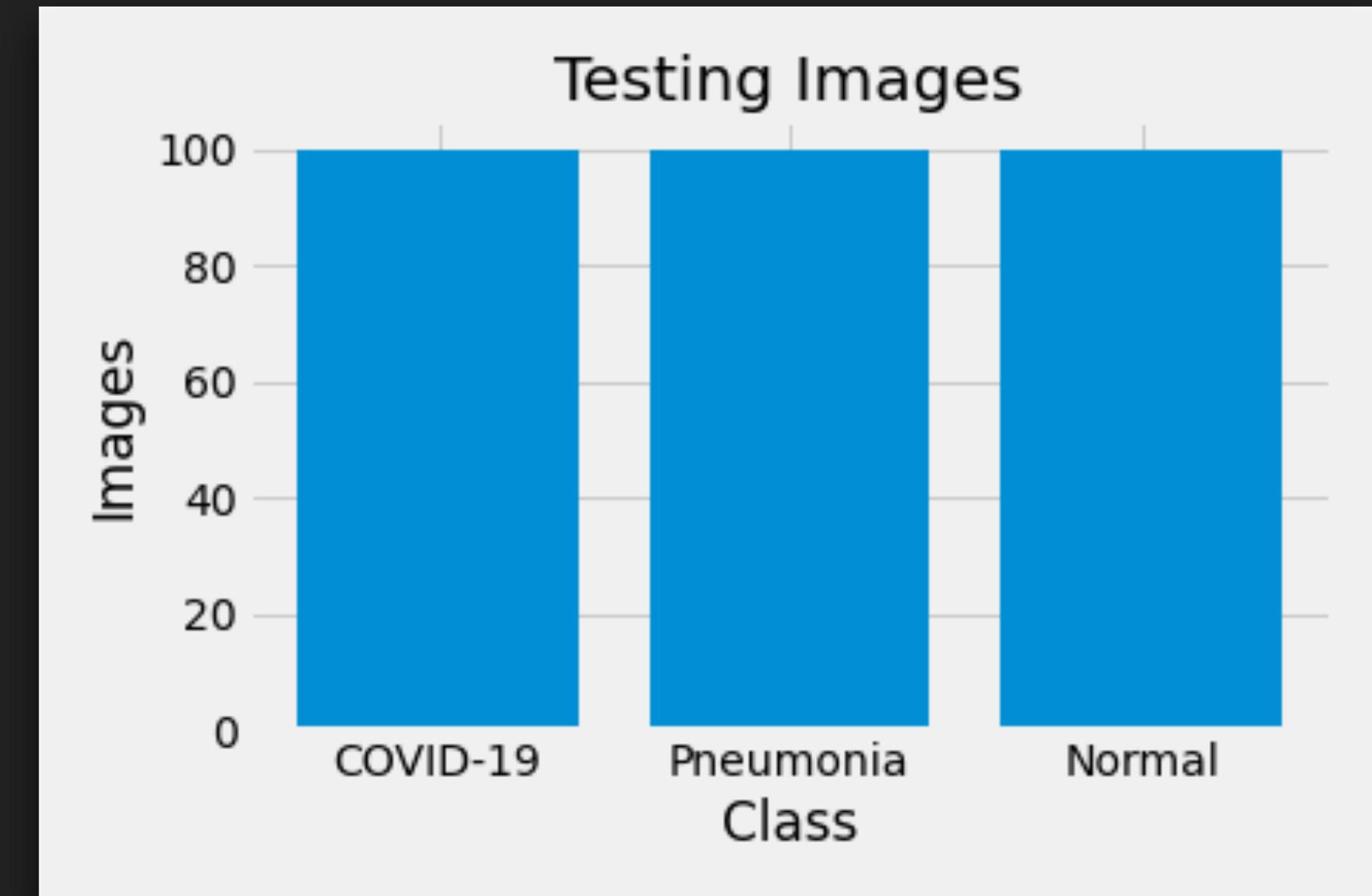
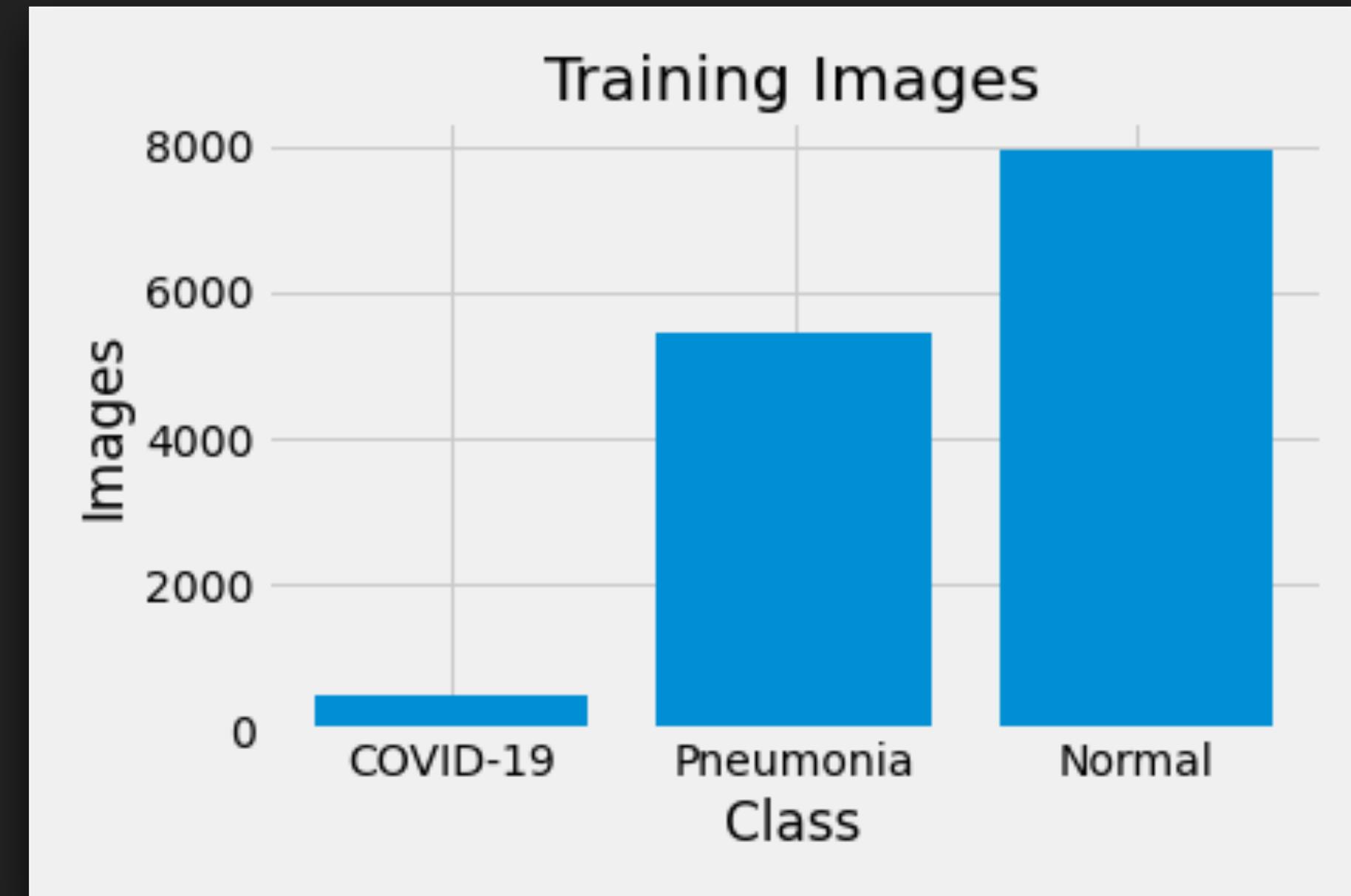
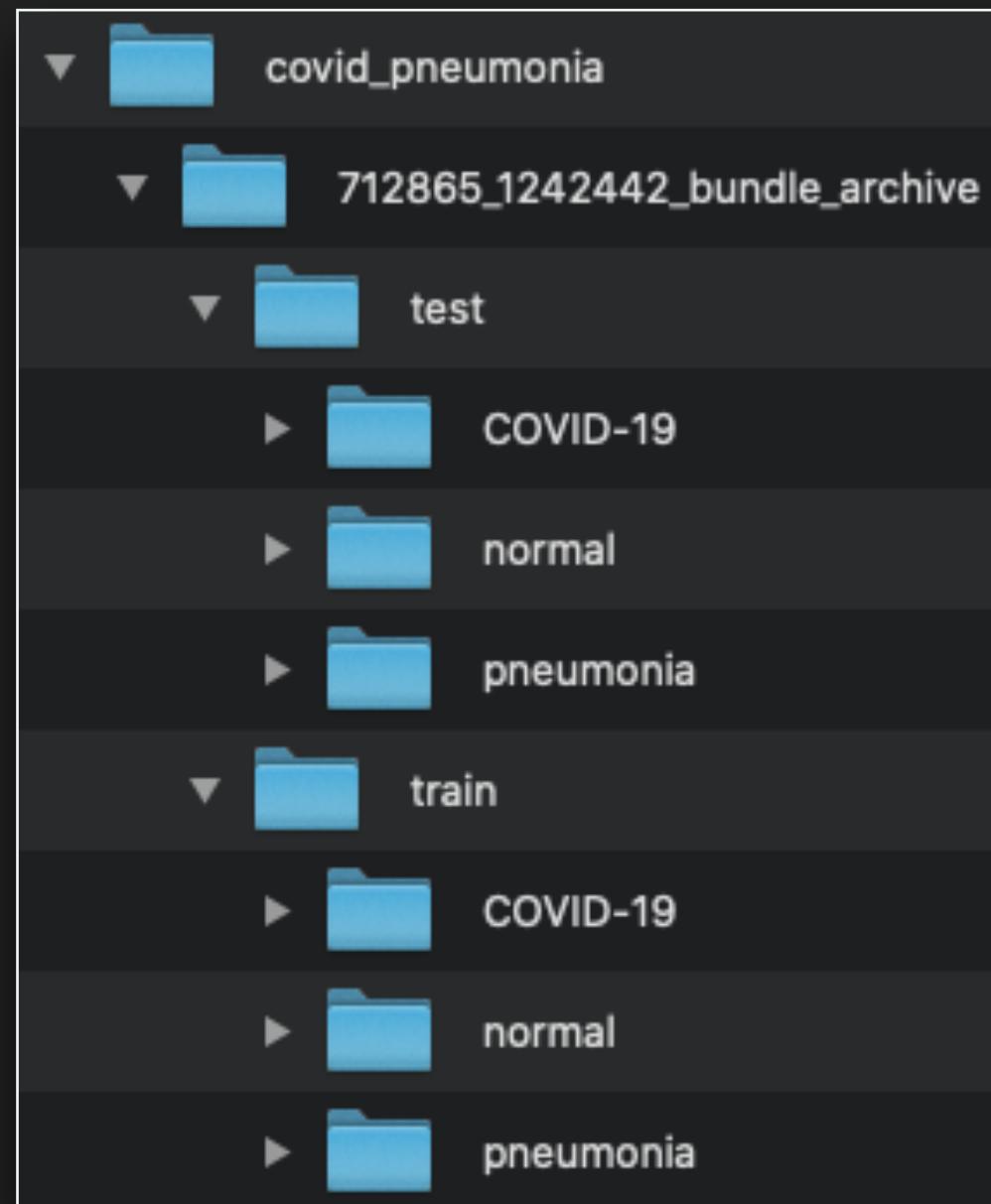


Pneumonia is an infection that inflames the air sacs in one or both lungs. The air sacs may fill with fluid or pus, causing a cough with phlegm or pus, fever, chills, and difficulty breathing. A variety of organisms, including bacteria, viruses and fungi, can cause pneumonia.



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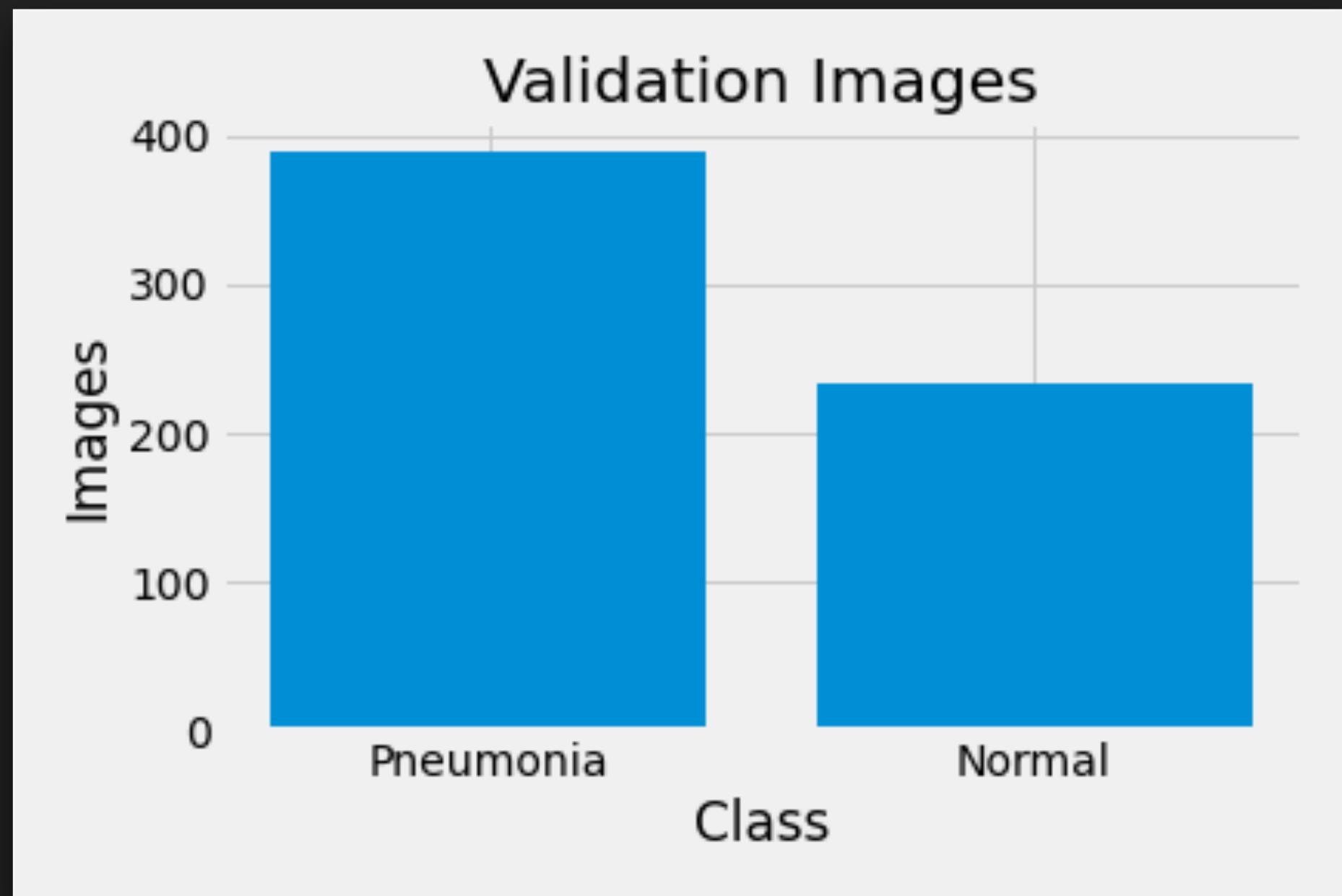
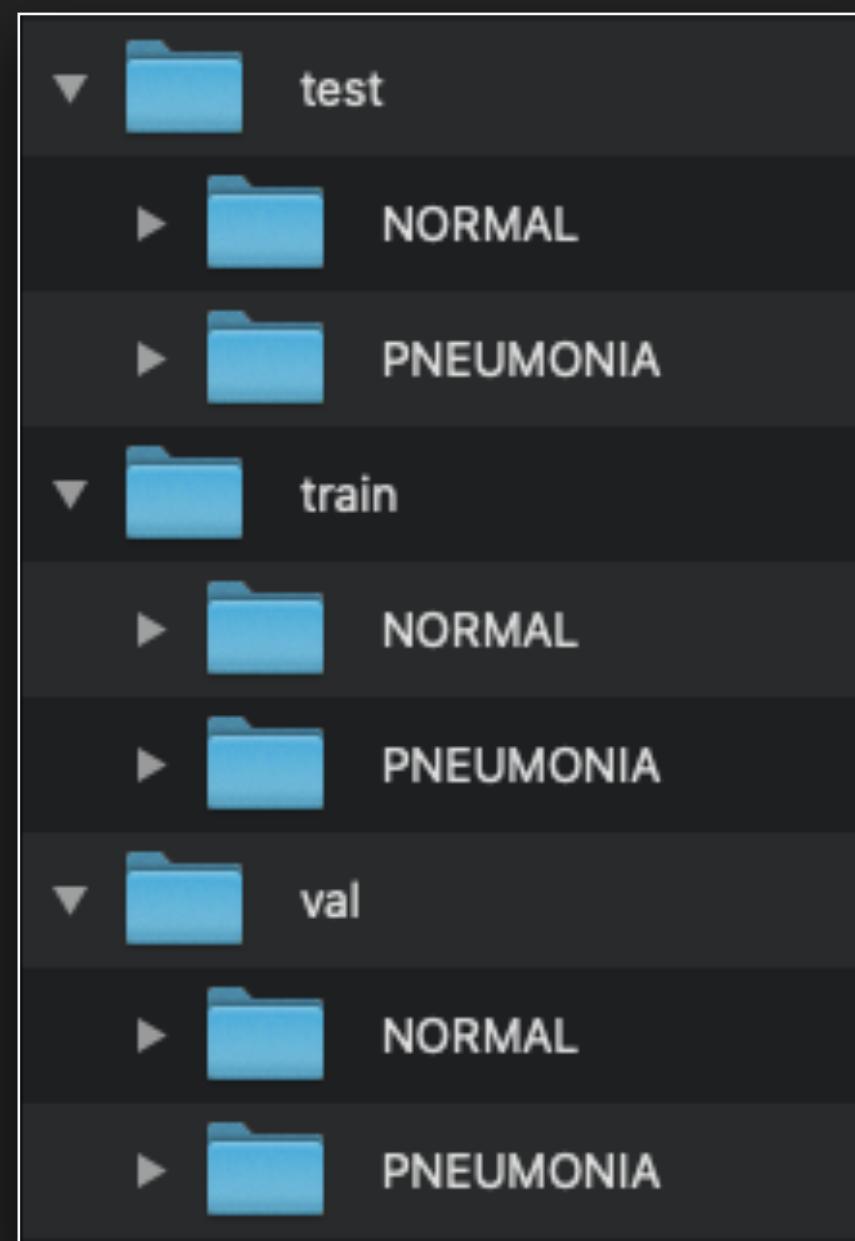
First Dataset



COVID-19 was removed to create a binary classification problem.

The model was learning to always predict normal.

New Dataset

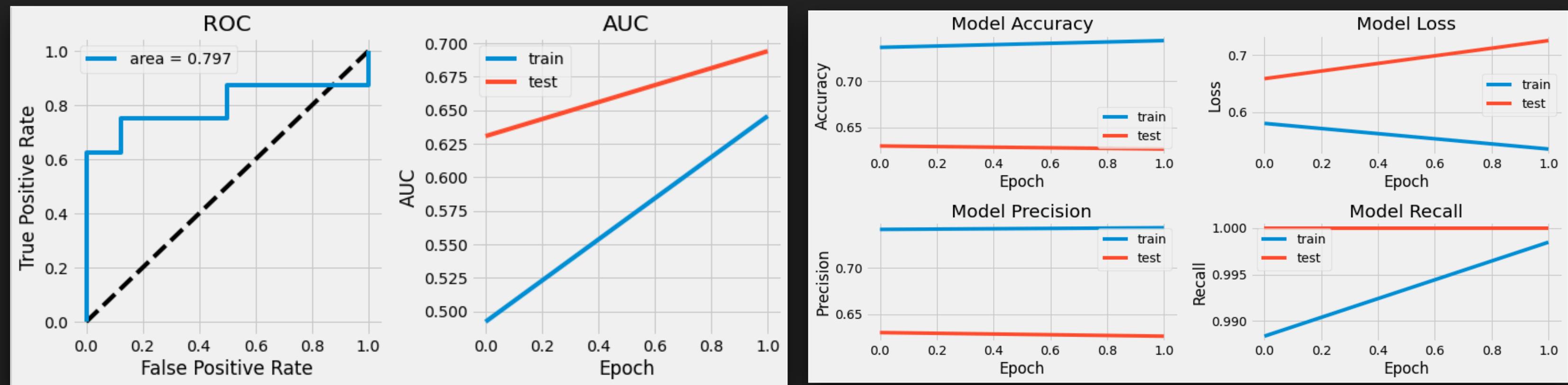


Interestingly enough, the model was now learning to always predict pneumonia after only a couple batches had processed.

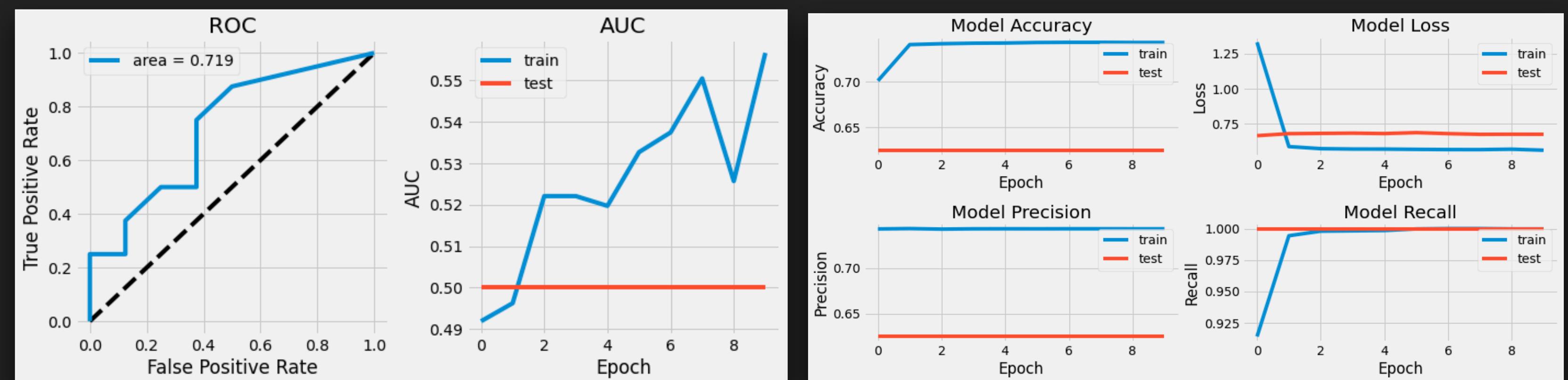
Model Progress

After Switching Datasets

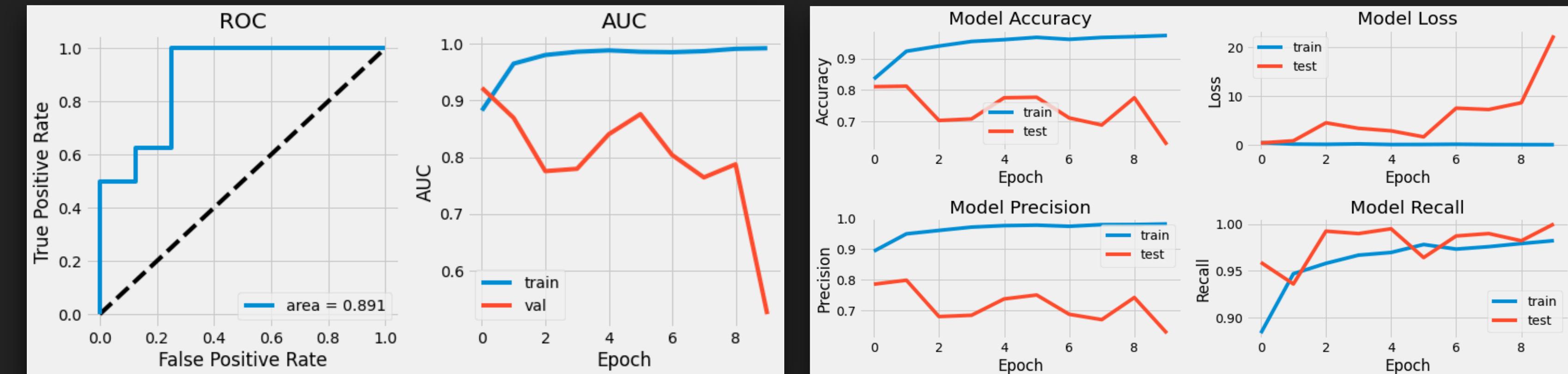
Initial



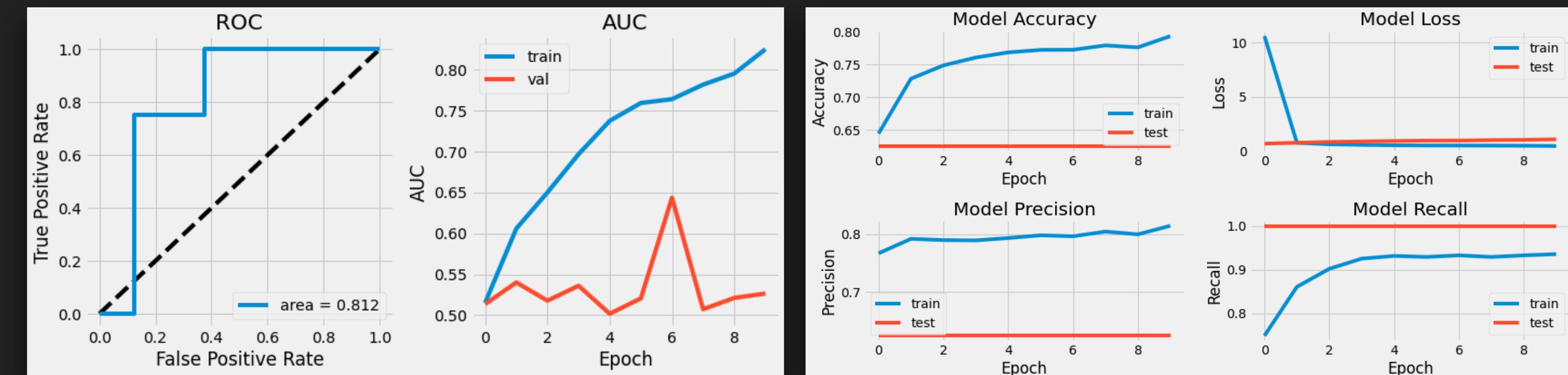
Removed
Grayscale and
Augmentation



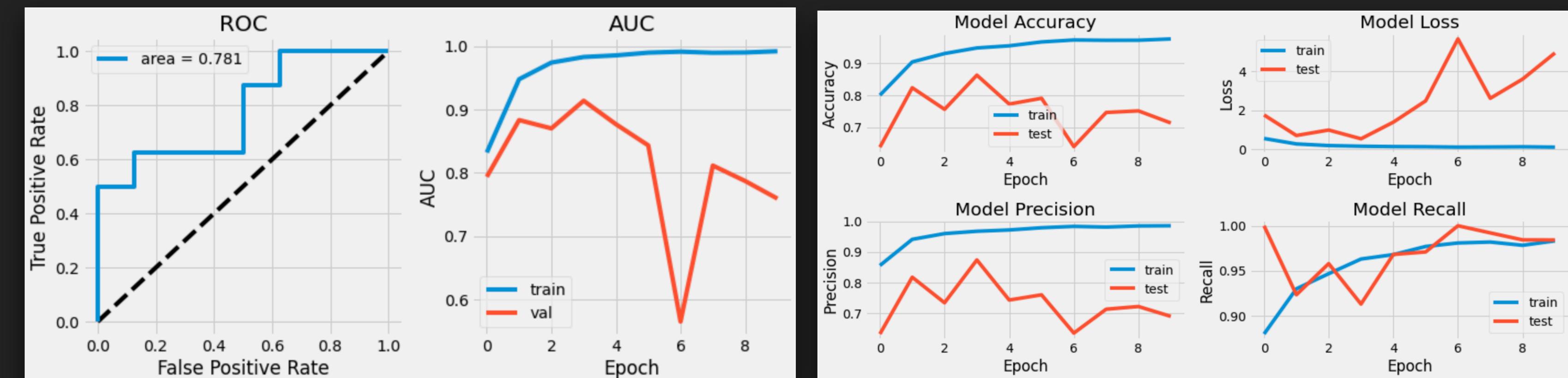
Unscaled Images / Removed Dropout



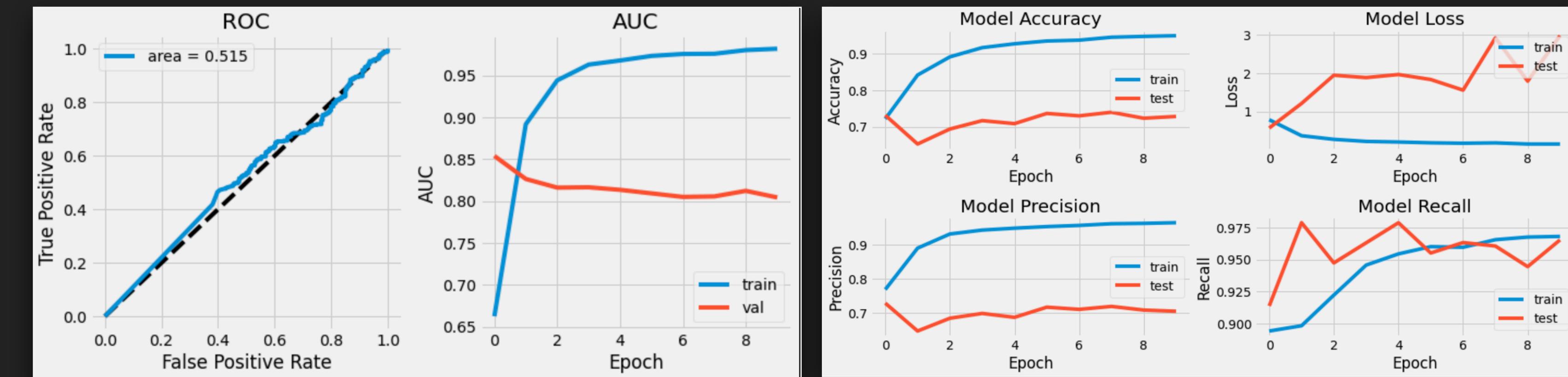
ReLU Activations / Added Dropout



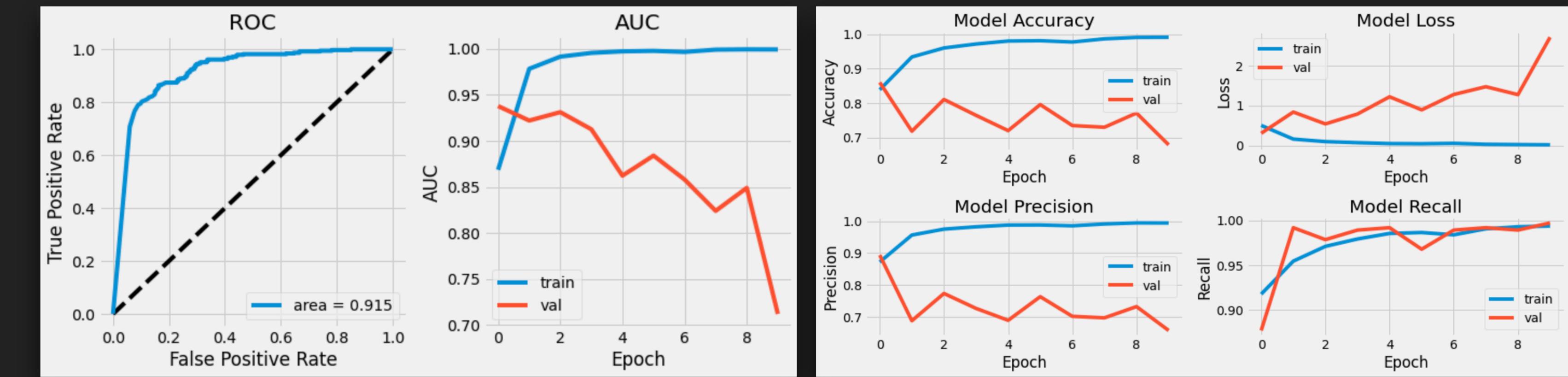
Weighted Normal to 2



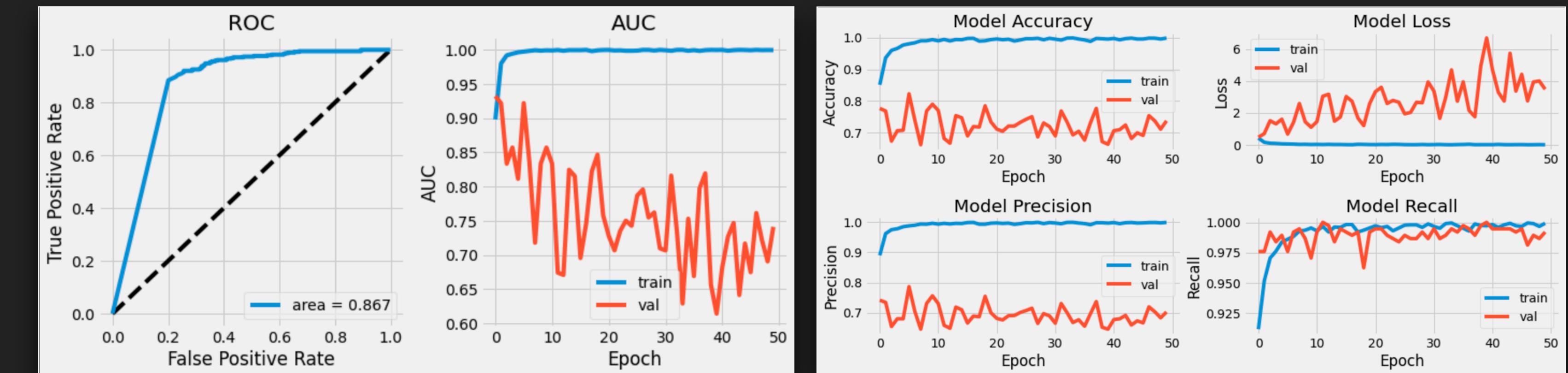
Changed Validation Images



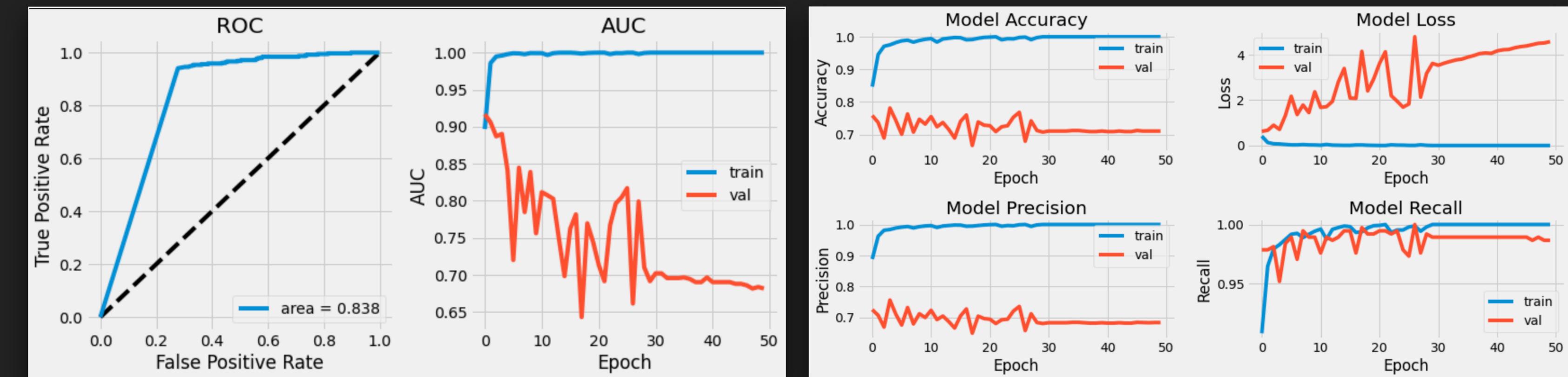
Removed Validation Shuffle



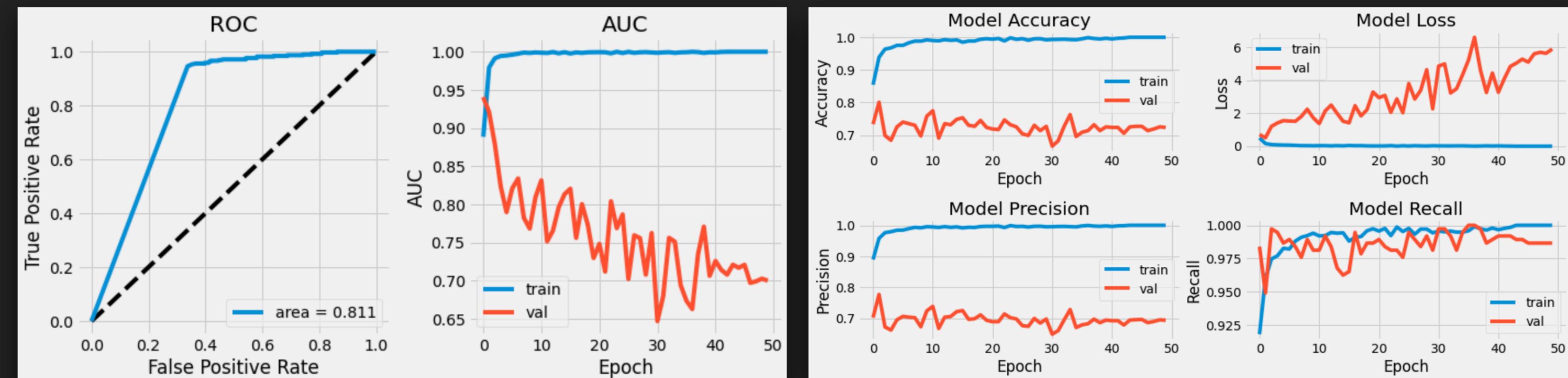
50 Epochs / 1 Dense Layer / Weighted Normal to 1.2



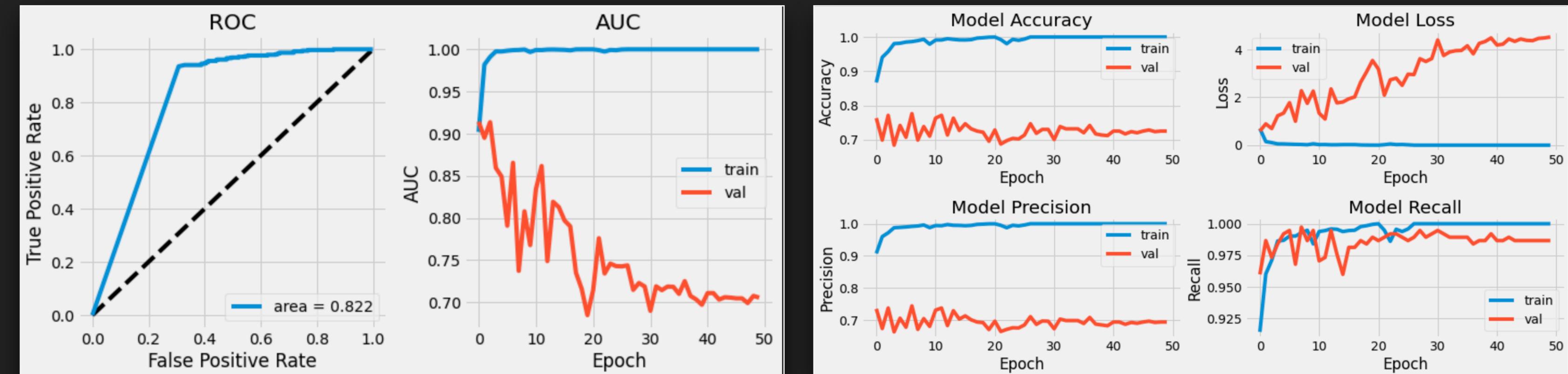
50 Epochs /
All Activations Swish



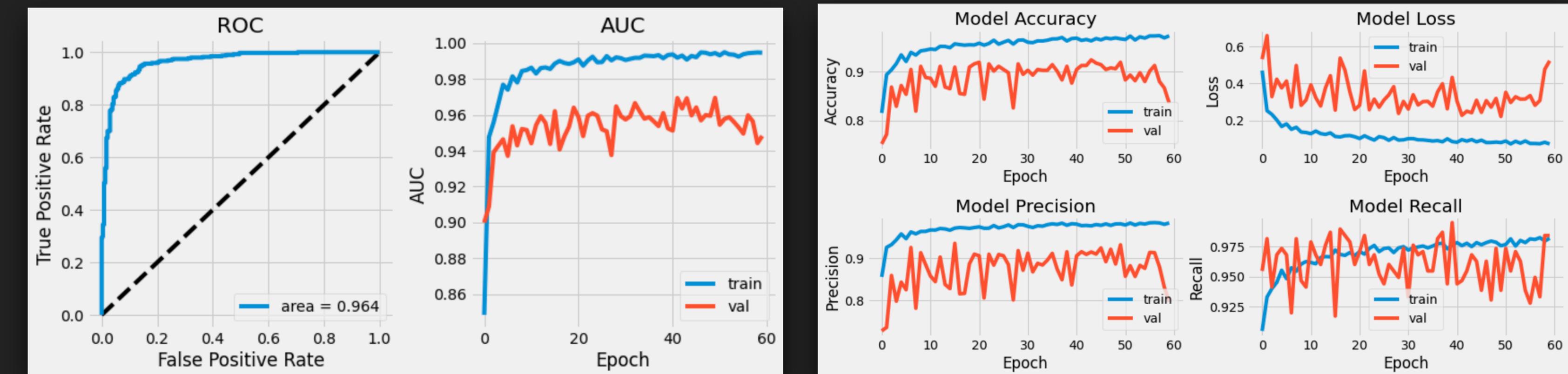
50 Epochs /
All Activations ReLU



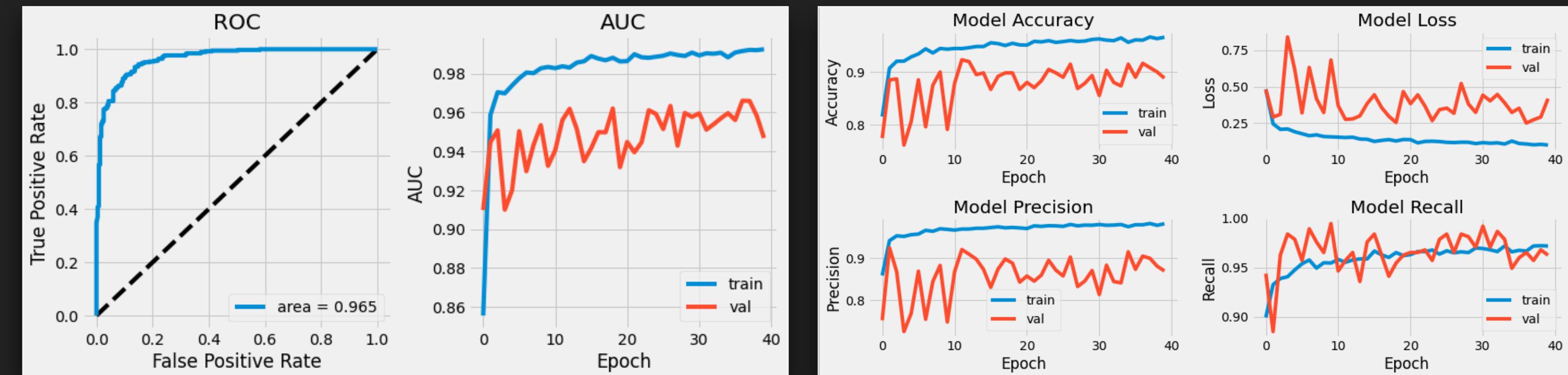
Removed last conv
layer. Dense units
512 to 256



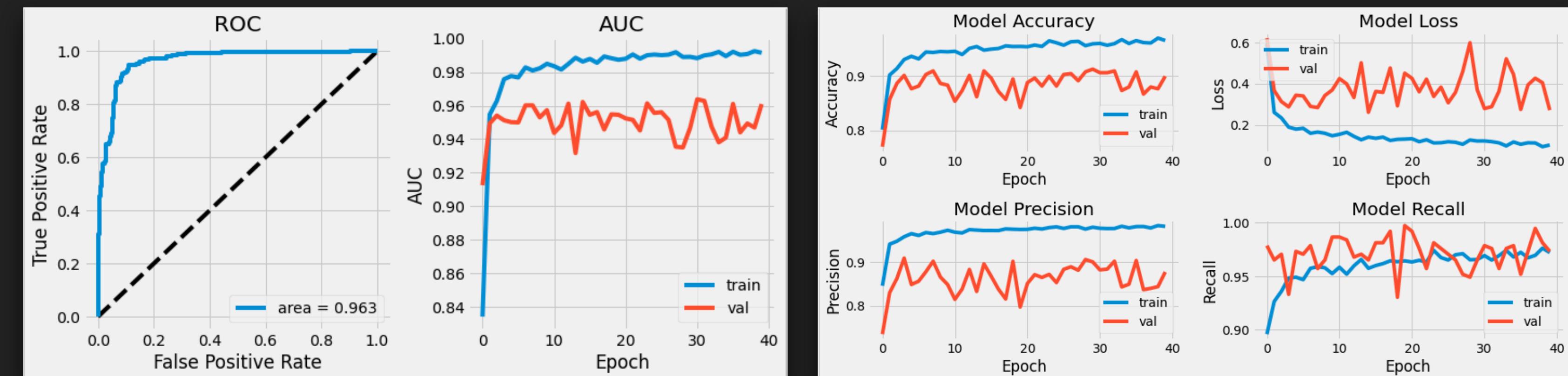
**Added
Augmentation /
60 Epochs /
Swish Activation**



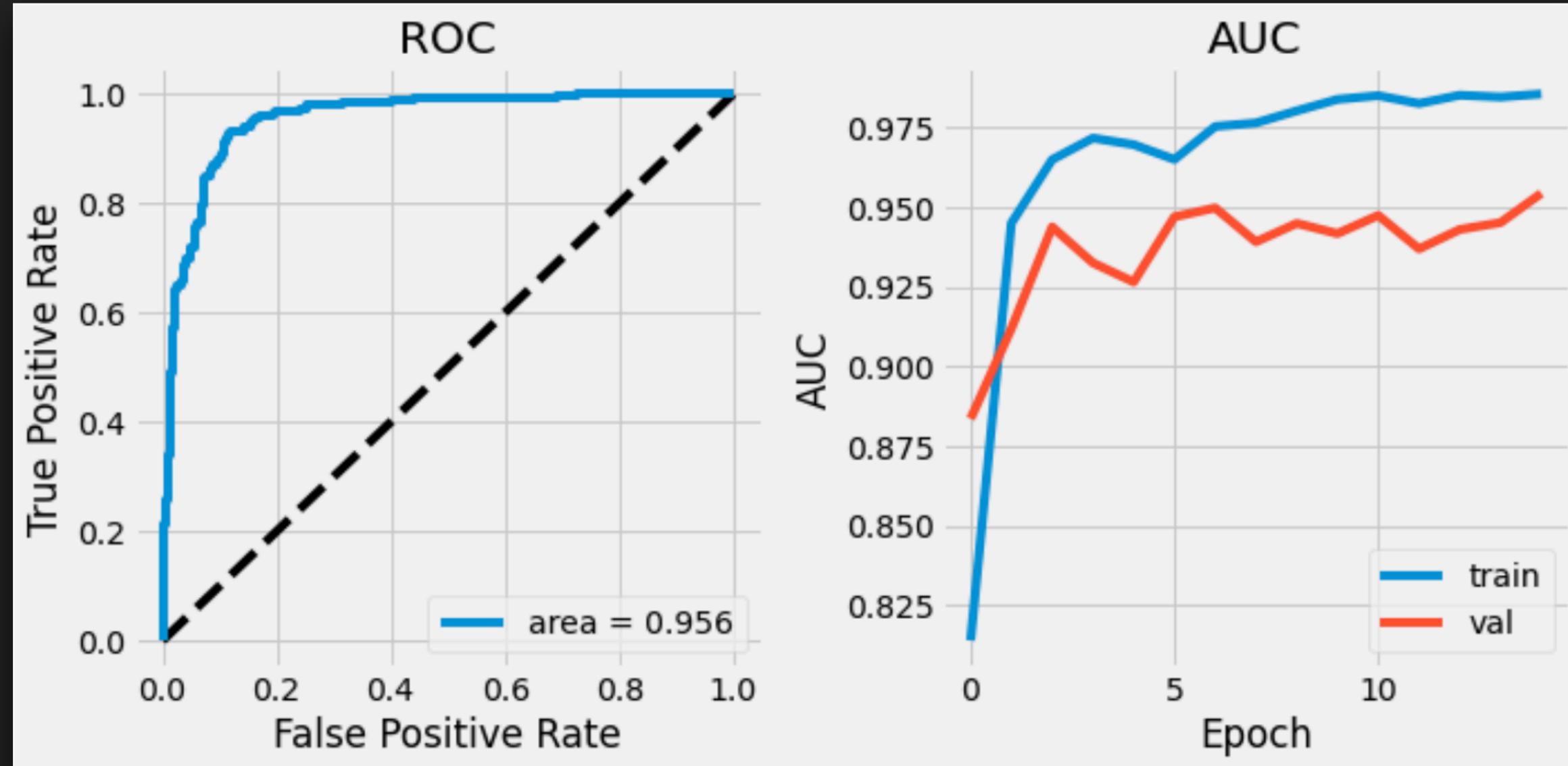
**Added Second
Dense Layer**



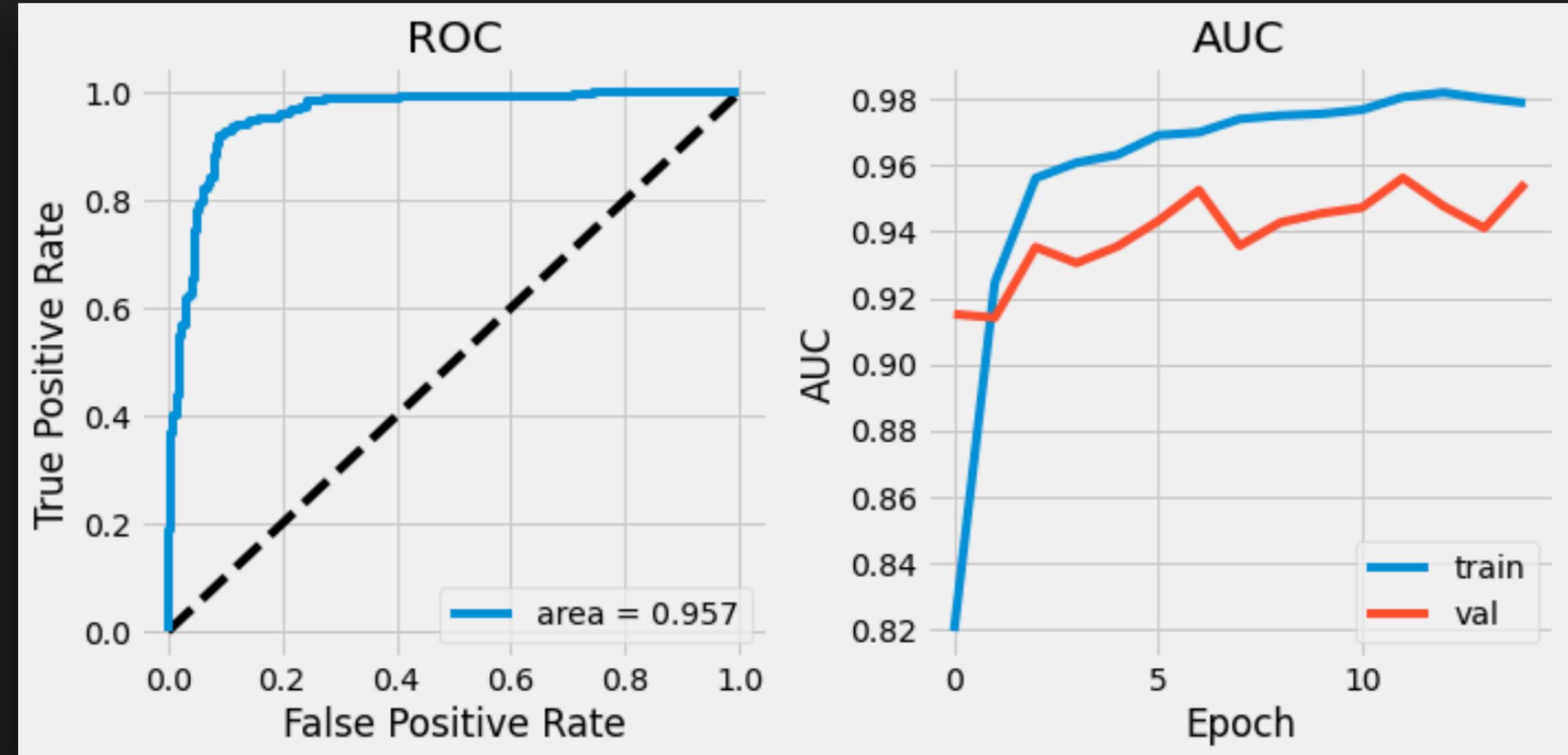
**Added Second
Dropout**



Swish

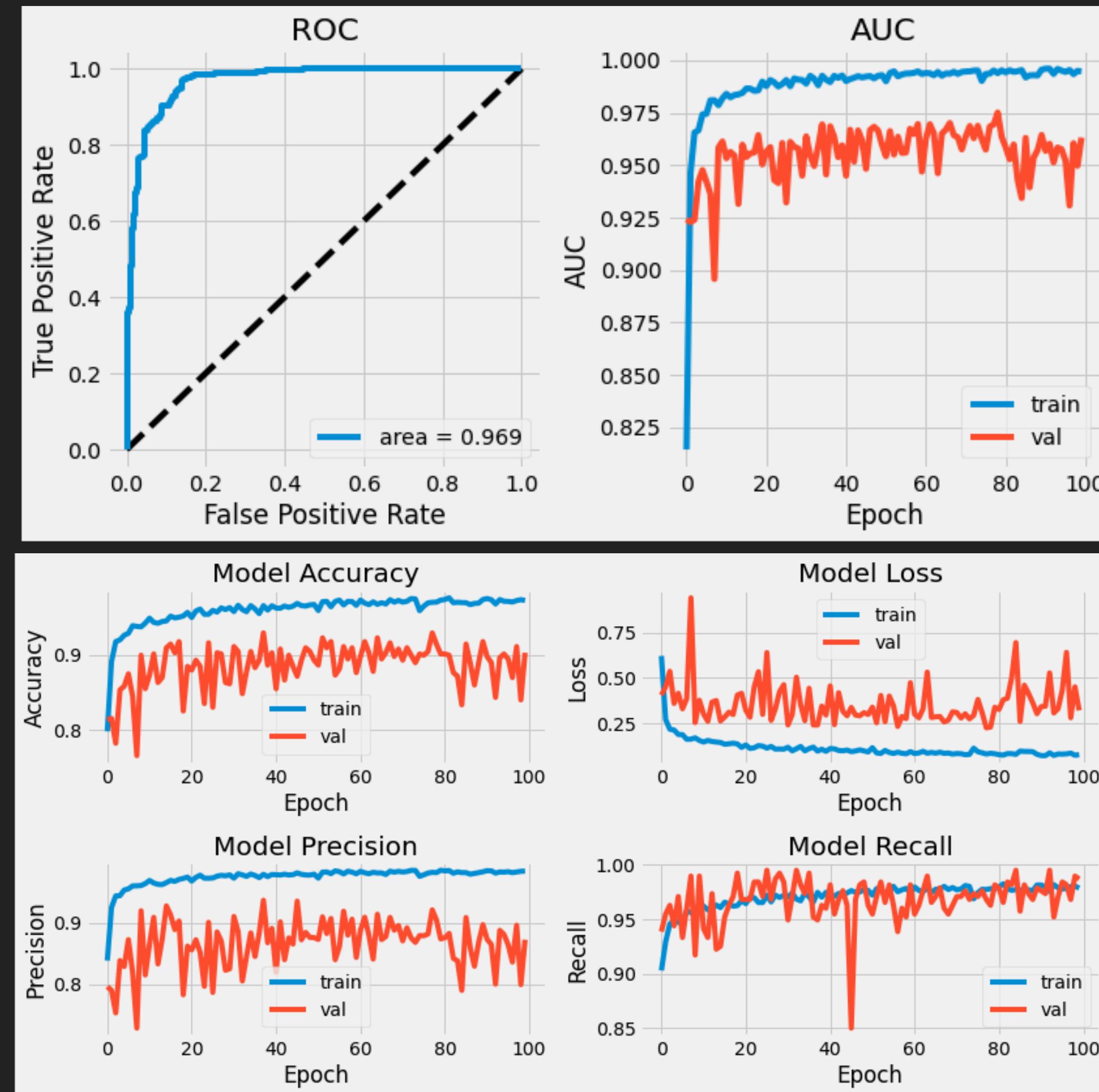


ReLU



Final Model

| Layer (type) | Output Shape | Param # |
|-------------------------------|----------------------|---------|
| conv2d_5 (Conv2D) | (None, 300, 300, 32) | 896 |
| max_pooling2d_5 (MaxPooling2) | (None, 150, 150, 32) | 0 |
| conv2d_6 (Conv2D) | (None, 150, 150, 64) | 18496 |
| max_pooling2d_6 (MaxPooling2) | (None, 75, 75, 64) | 0 |
| conv2d_7 (Conv2D) | (None, 38, 38, 64) | 36928 |
| max_pooling2d_7 (MaxPooling2) | (None, 19, 19, 64) | 0 |
| conv2d_8 (Conv2D) | (None, 10, 10, 128) | 73856 |
| max_pooling2d_8 (MaxPooling2) | (None, 5, 5, 128) | 0 |
| conv2d_9 (Conv2D) | (None, 3, 3, 128) | 147584 |
| max_pooling2d_9 (MaxPooling2) | (None, 1, 1, 128) | 0 |
| flatten_1 (Flatten) | (None, 128) | 0 |
| dense_2 (Dense) | (None, 256) | 33024 |
| dropout_1 (Dropout) | (None, 256) | 0 |
| dense_3 (Dense) | (None, 1) | 257 |



Accuracy: 0.9030 AUC: 0.9631
 Precision: 0.8723 Recall: 0.9866

Conclusions

Next Steps

Apply this model to X-rays from the local hospital

Go back and try COVID again

Pneumonia

