

A black and white chest X-ray image occupies the left half of the frame. It shows the bony structures of the ribcage and spine on the left, and the internal organs of the thoracic cavity. The right side of the image is heavily blurred, creating a soft, out-of-focus effect.

PNEUMONIA DIAGNOSIS

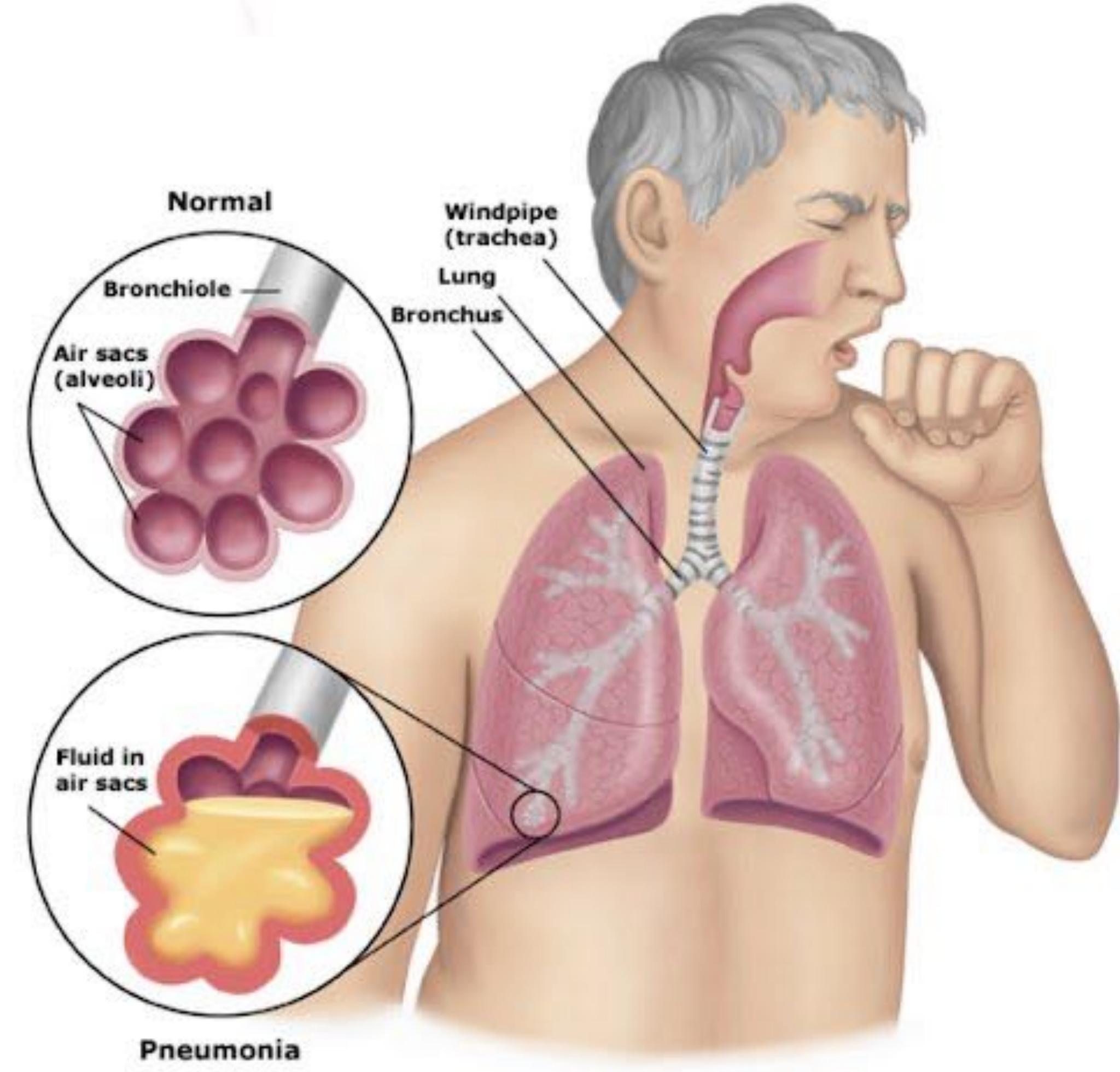
ACCURACY & RAPIDITY OF SCANNING CHEST
X-RAY IMAGES USING DEEP LEARNING MODELS

BY AMIR KHOELAR

INTRODUCTION

WHAT IS PNEUMONIA?

- Lung infection
- Mild ~ Severe
- Infection causes the lung air sacs (alveoli) fill up with fluid/pus
- Breathing difficulty - not enough oxygen reaching bloodstream
- Highest risk age (under 2 , over 65) - weaker immune system
- Bacterial, Virus, or Fungi - infectious in first 2



INTRODUCTION

PNEUMONIA SYMPTOMS

- A. Chest Pain
- B. Cough with mucus
- C. Fatigue or loss of appetite
- D. Fever, sweat and chills
- E. Nausea, vomiting and diarrhea
- F. Shortness of breath



INTRODUCTION

THE STUDY

- Question: How to increase diagnosis efficiency of Pneumonia in hospitals?
- SOLUTION: Use of deep learning models to scan chest X-ray for patients likely to have Pneumonia





IMPACT & SUCCESS:

- INCREASE OF PRECISION & SPEED OF DIAGNOSIS
- PREVENTION & DECREASE THE RATE OF HOSPITALIZATION
- ELIMINATION OF DOCTOR/HUMAN ERROR IN DIAGNOSIS

DATA & PRE-PROCESSING &EDA

LIBRARIES & TOOLS

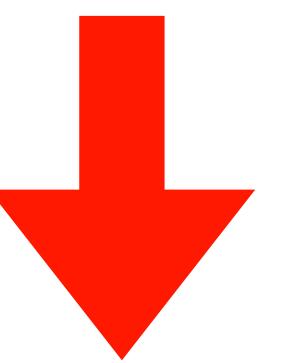
- DATA
 - Kaggle Chest X-ray Images for Pneumonia
 - 5600 Chest Xray Images
 - 624 Extra Chest Xray Images
- Pre-processing
 - Numpy, pandas
 - Keras/Tensor flow
 - Scikit-learn
- EDA
 - Matplotlib, Seaborn



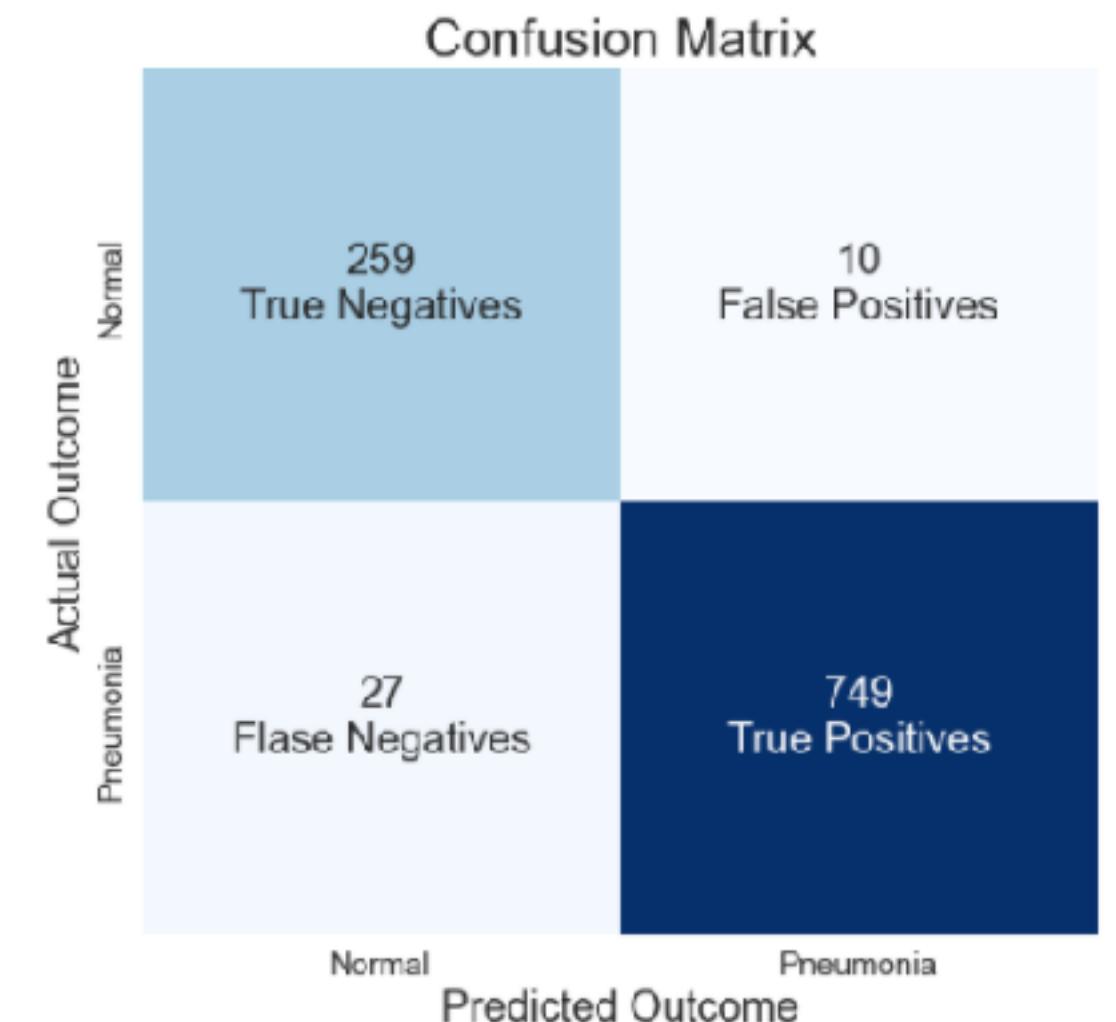
RESULTS

DEEP LEARNING MODELS

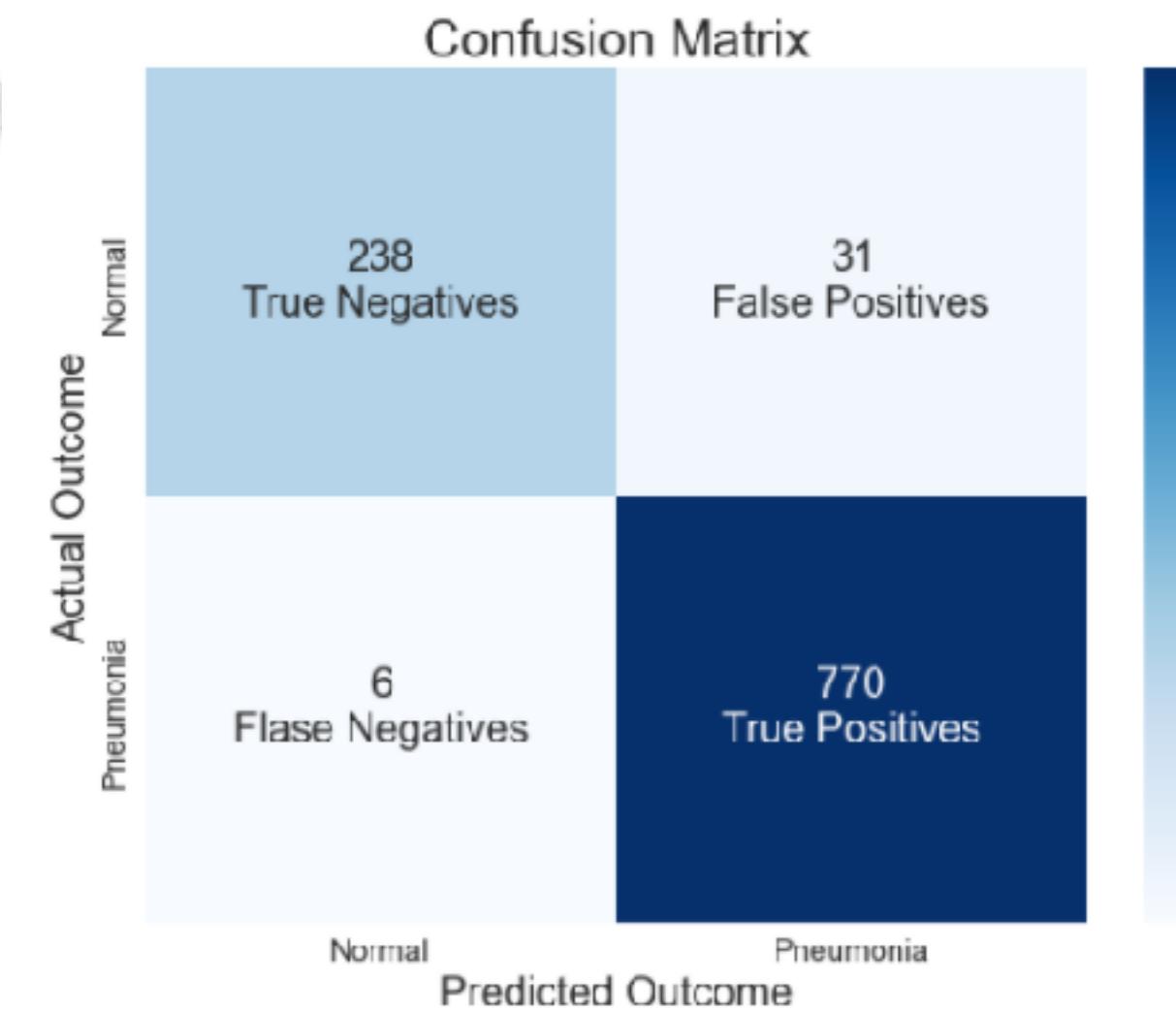
Model	Status	Precision	Recall	F1
CNN Baseline	Normal	0.91	0.96	0.93
	Pneumonia	0.99	0.97	0.98
CNN Reg 1	Normal	0.98	0.88	0.93
	Pneumonia	0.96	0.99	0.98
CNN Reg 2	Normal	0.94	0.95	0.94
	Pneumonia	0.98	0.98	0.98
MobileNet	Normal	0.95	0.62	0.75
	Pneumonia	0.88	0.99	0.93



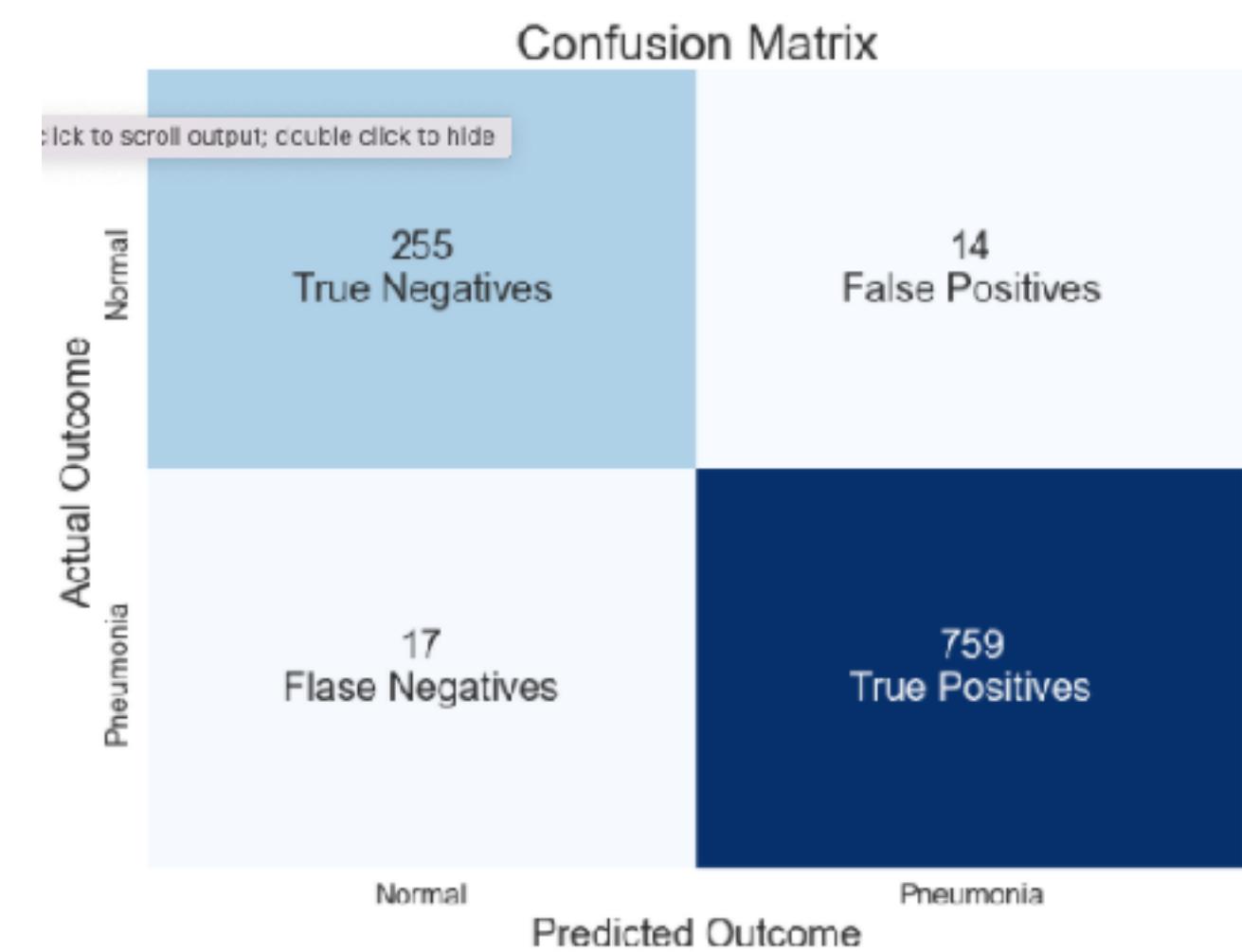
CNN Baseline



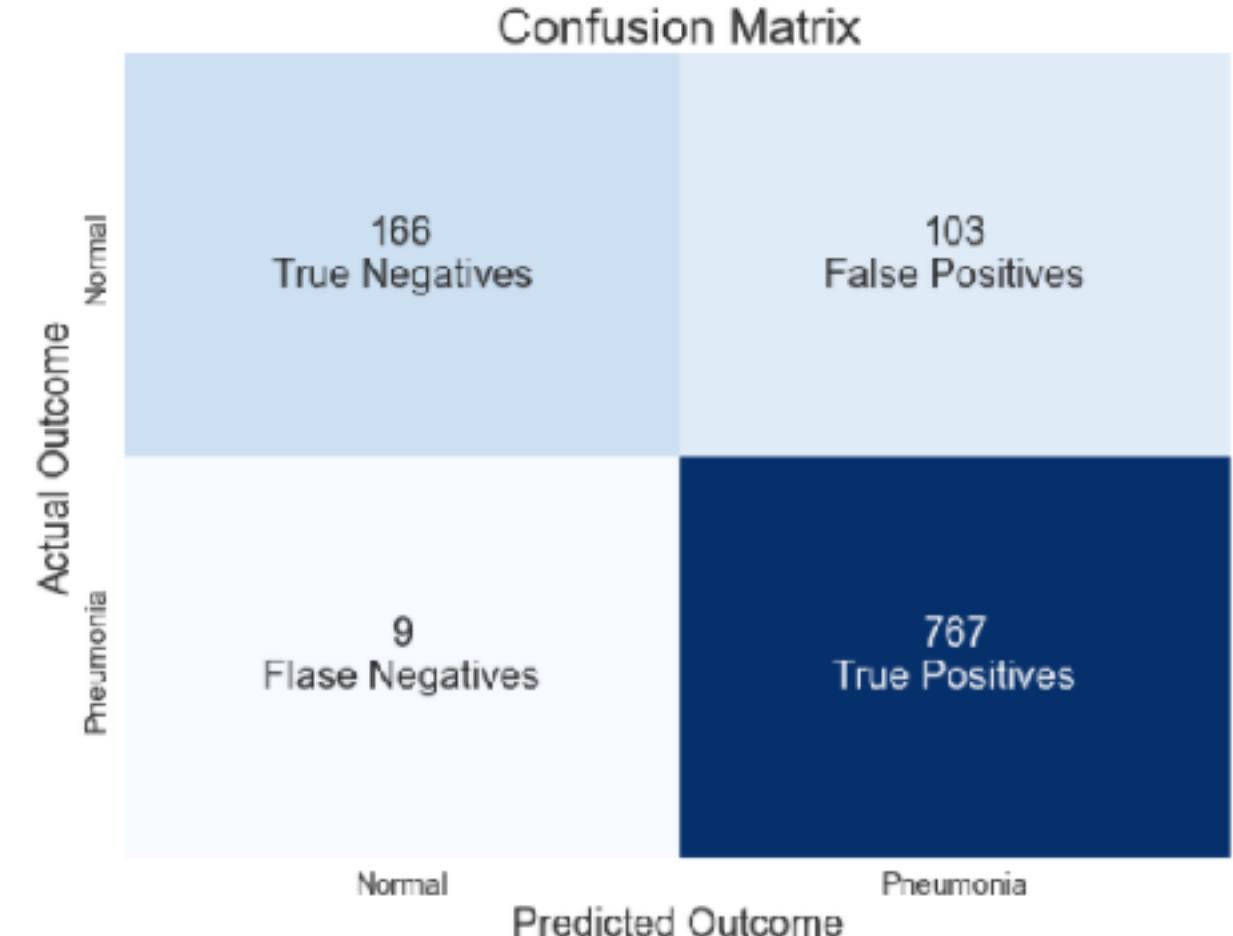
CNN Reg1



CNN Reg2



MobileNet

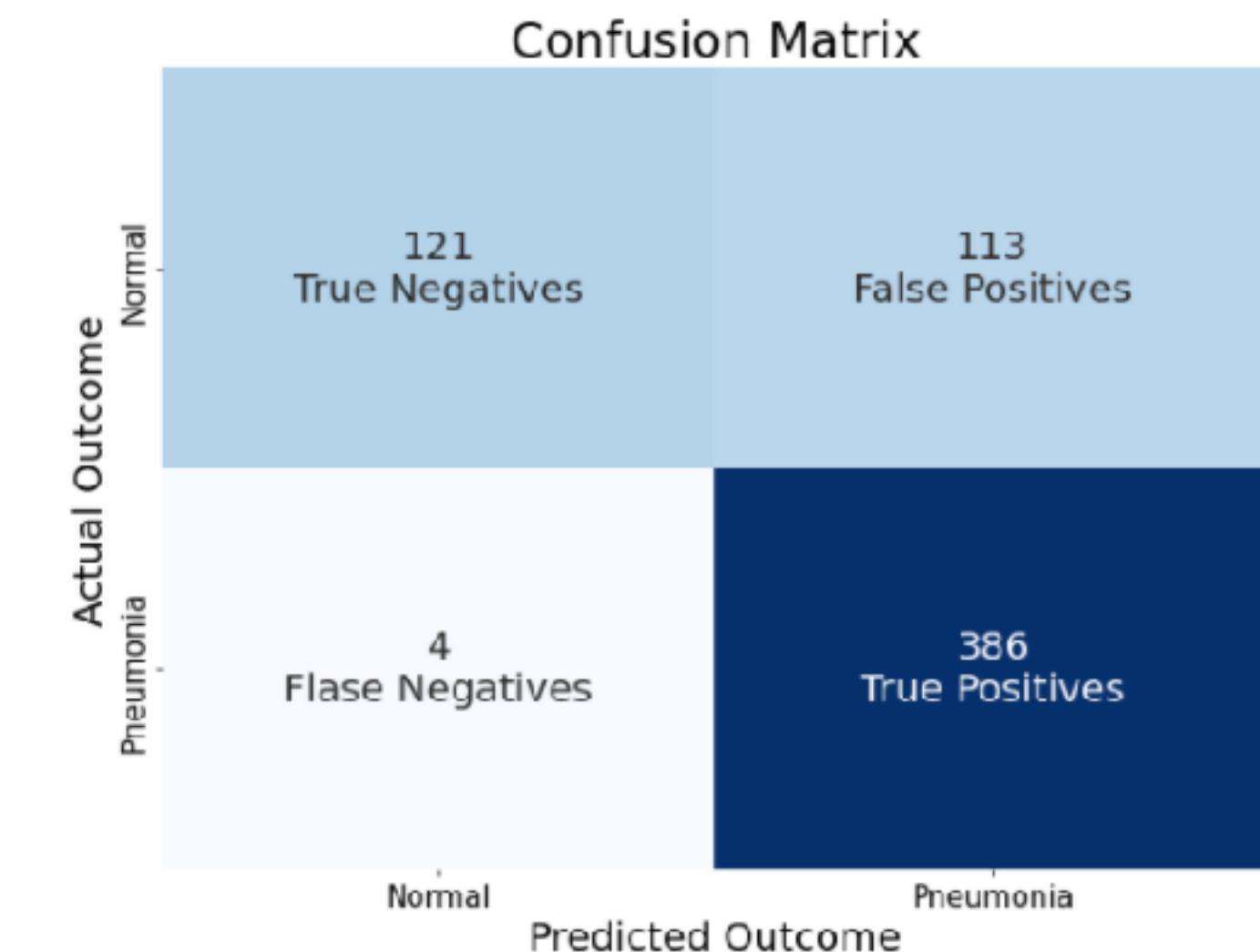


RESULTS

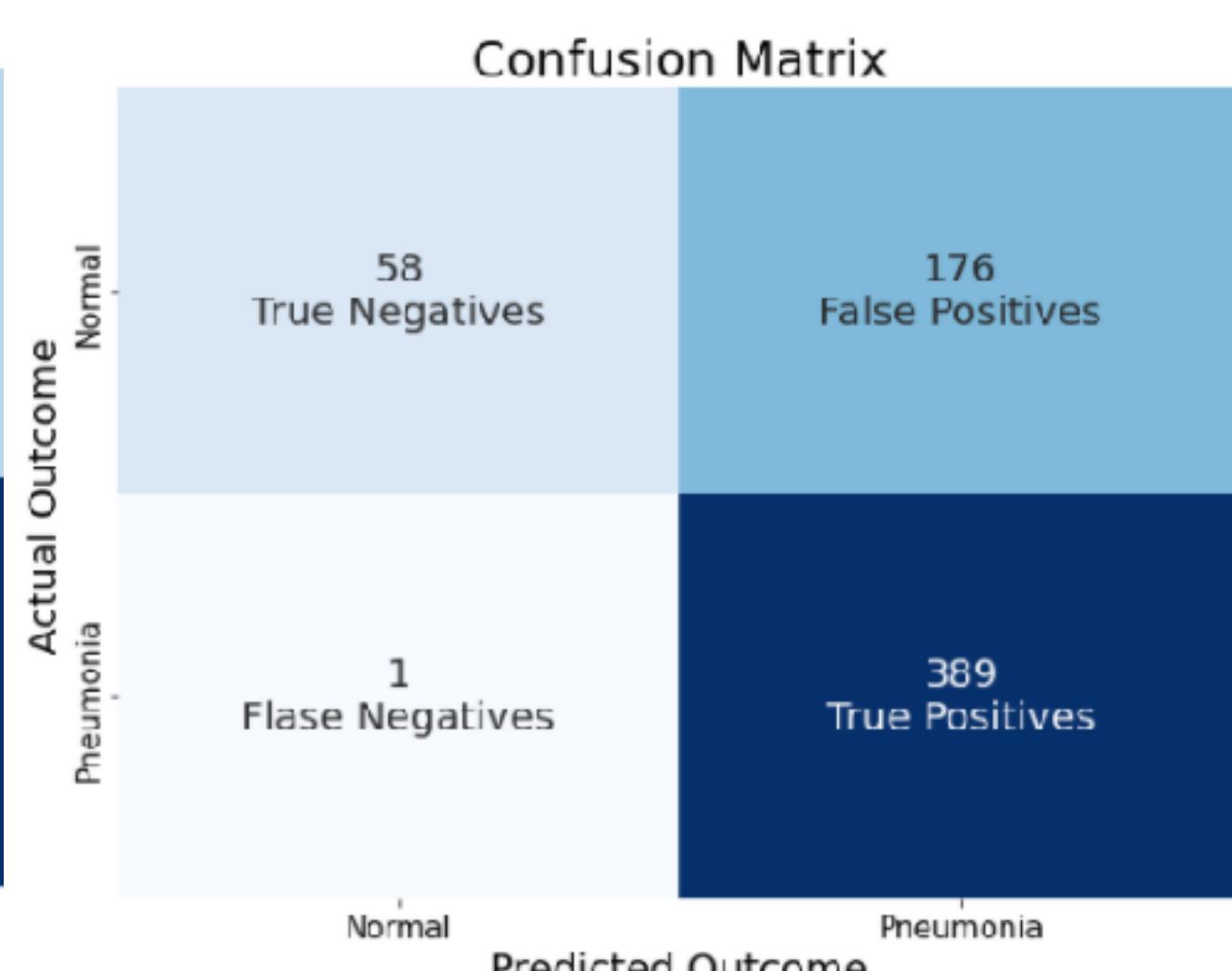
DEEP LEARNING MODELS - EXTRA TEST

Model	Status	Precision	Recall	F1
CNN Baseline	Normal	0.97	0.52	0.67
CNN Baseline	Pneumonia	0.77	0.99	0.87
CNN Reg 1	Normal	0.98	0.25	0.4
CNN Reg 1	Pneumonia	0.69	1.00	0.81
CNN Reg 2	Normal	0.97	0.31	0.47
CNN Reg 2	Pneumonia	0.71	0.99	0.83
MobileNet	Normal	0.95	0.62	0.75
MobileNet	Pneumonia	0.88	0.99	0.93

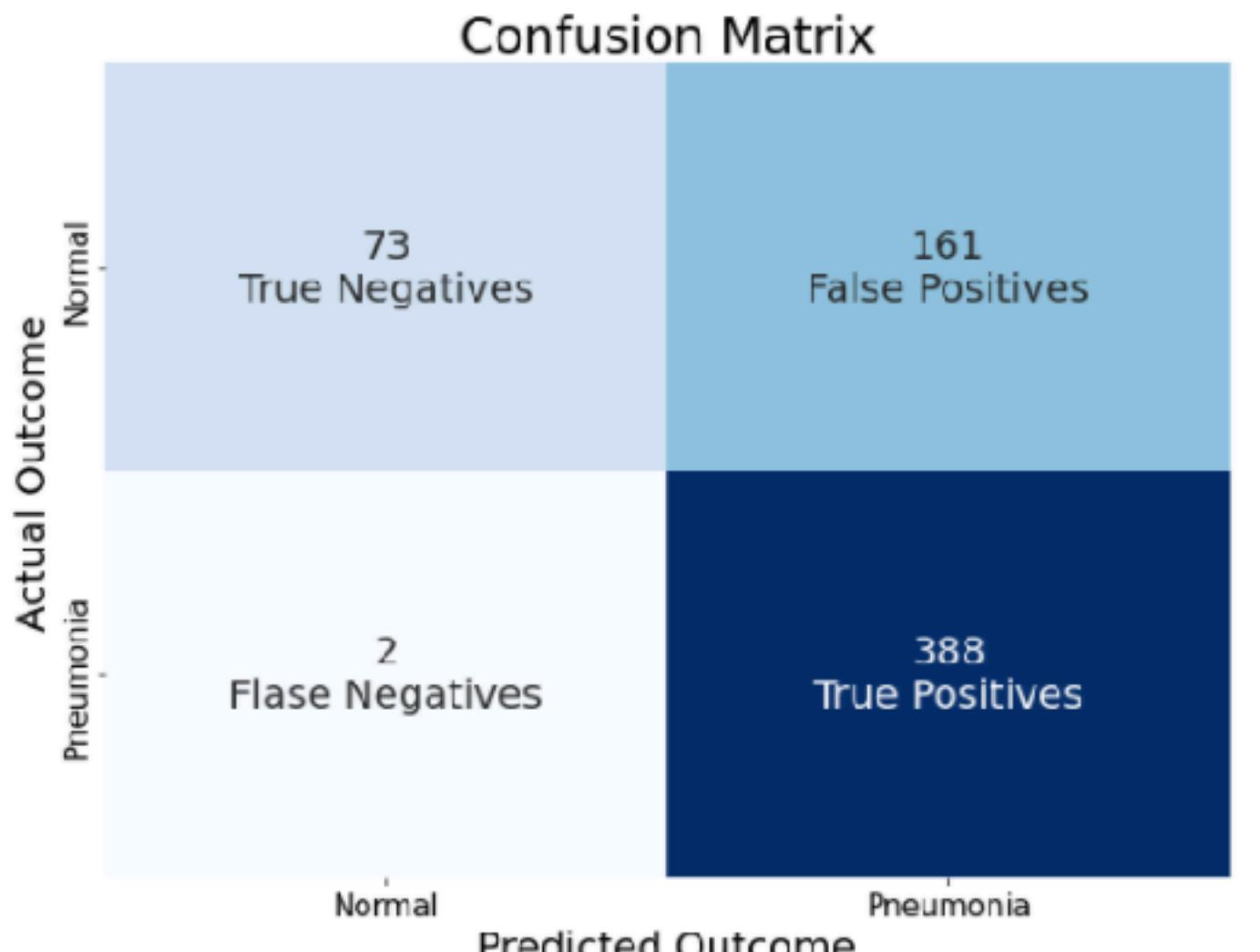
CNN Baseline



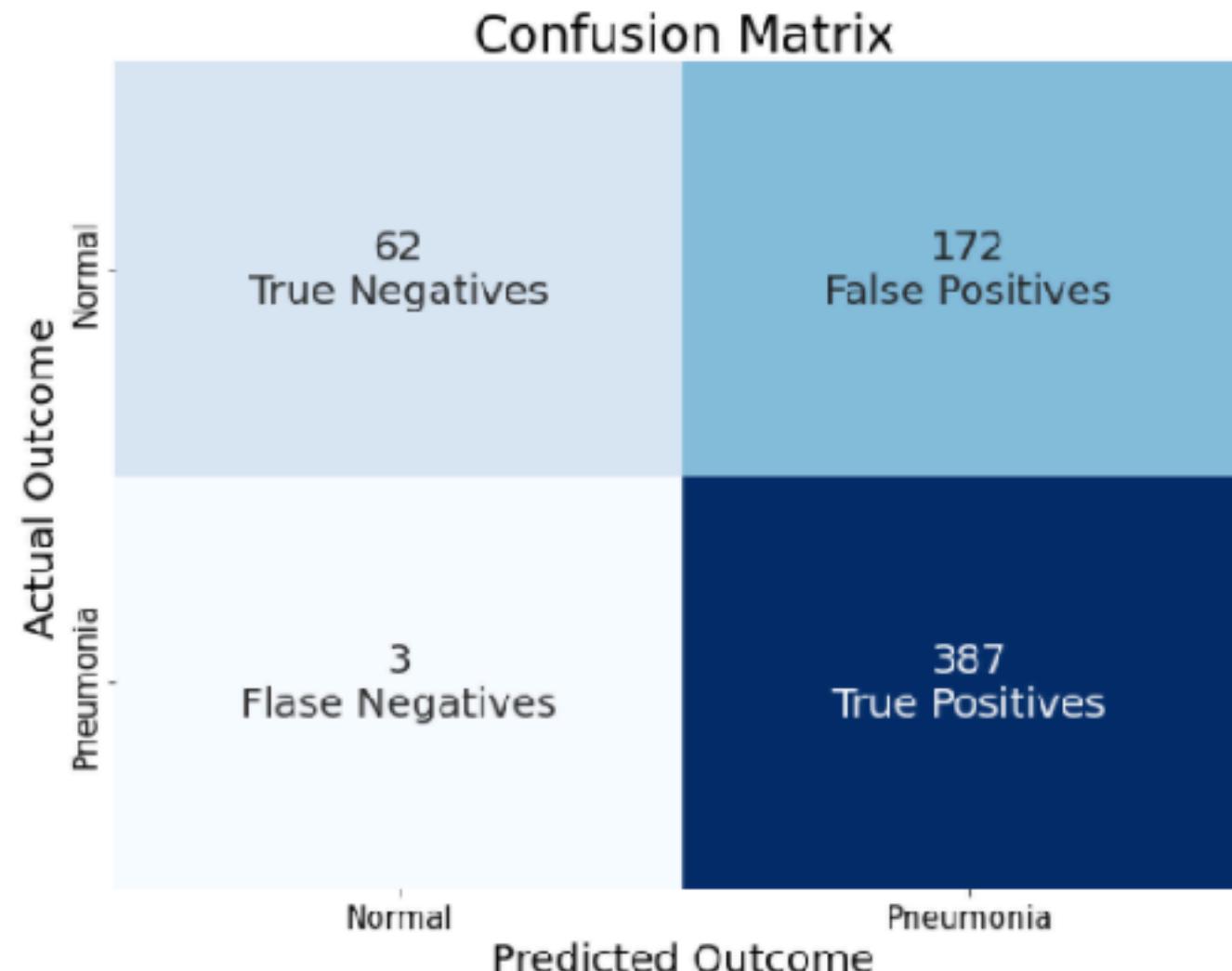
CNN Reg1



CNN Reg2



MobileNet



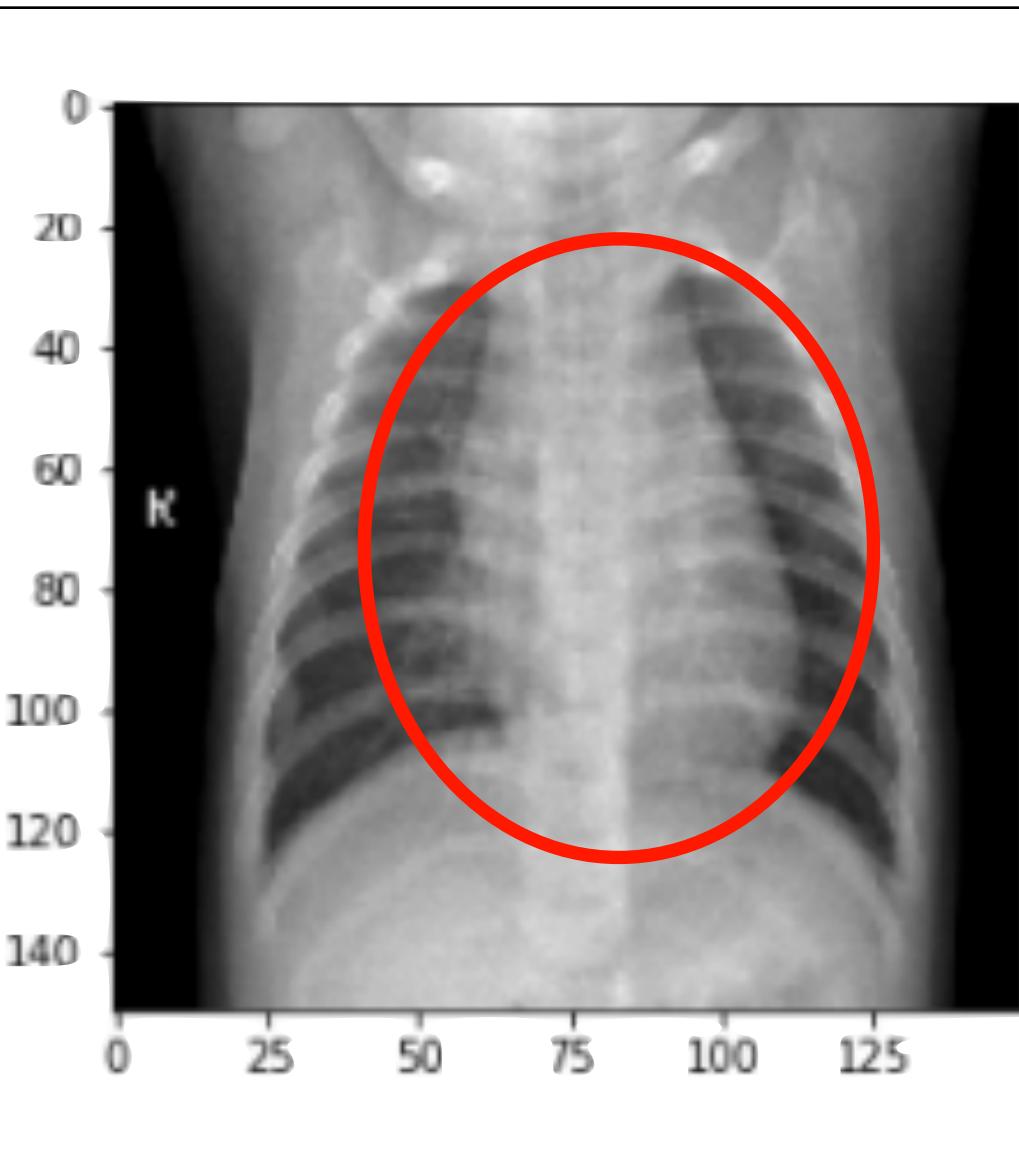
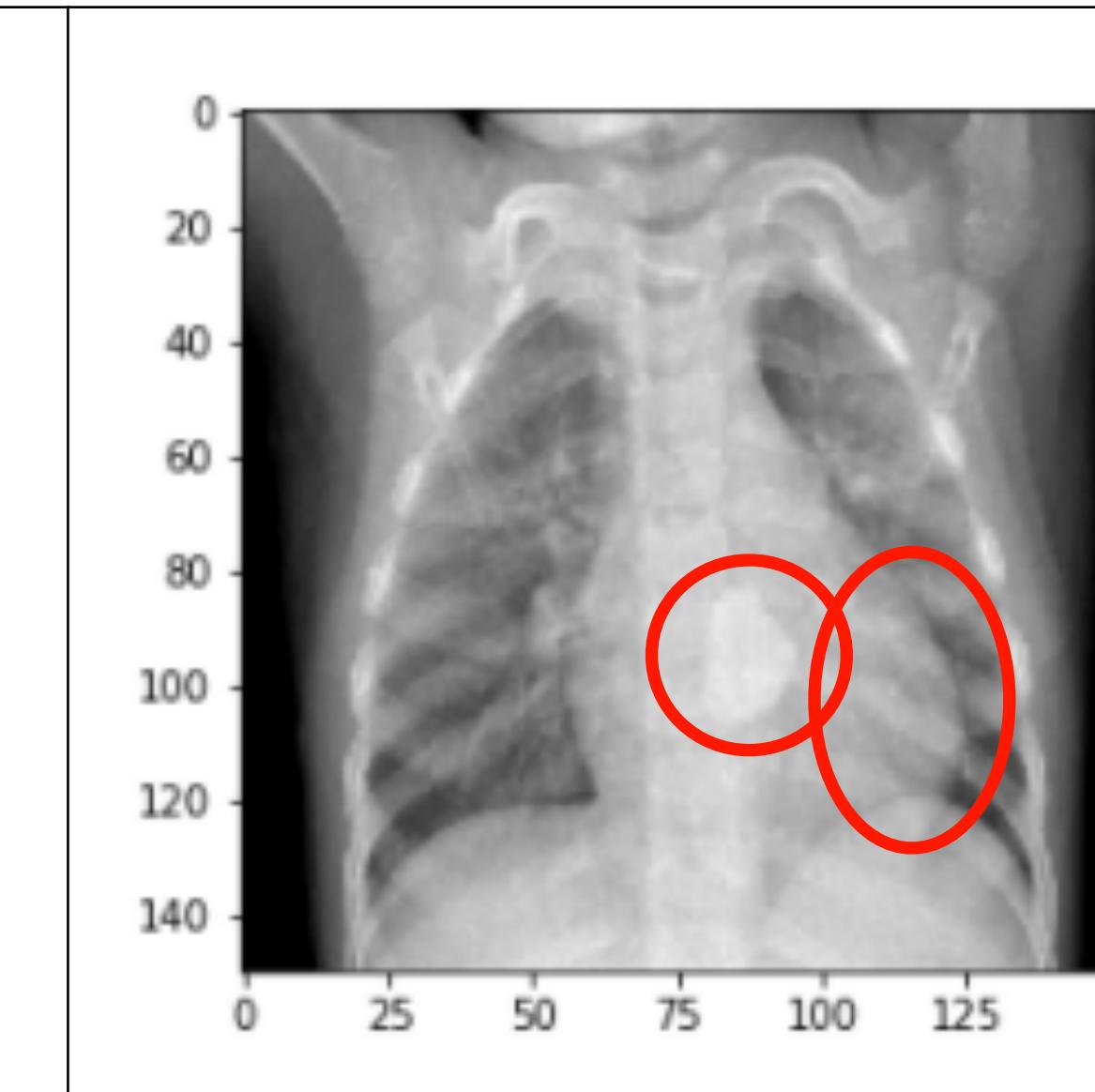
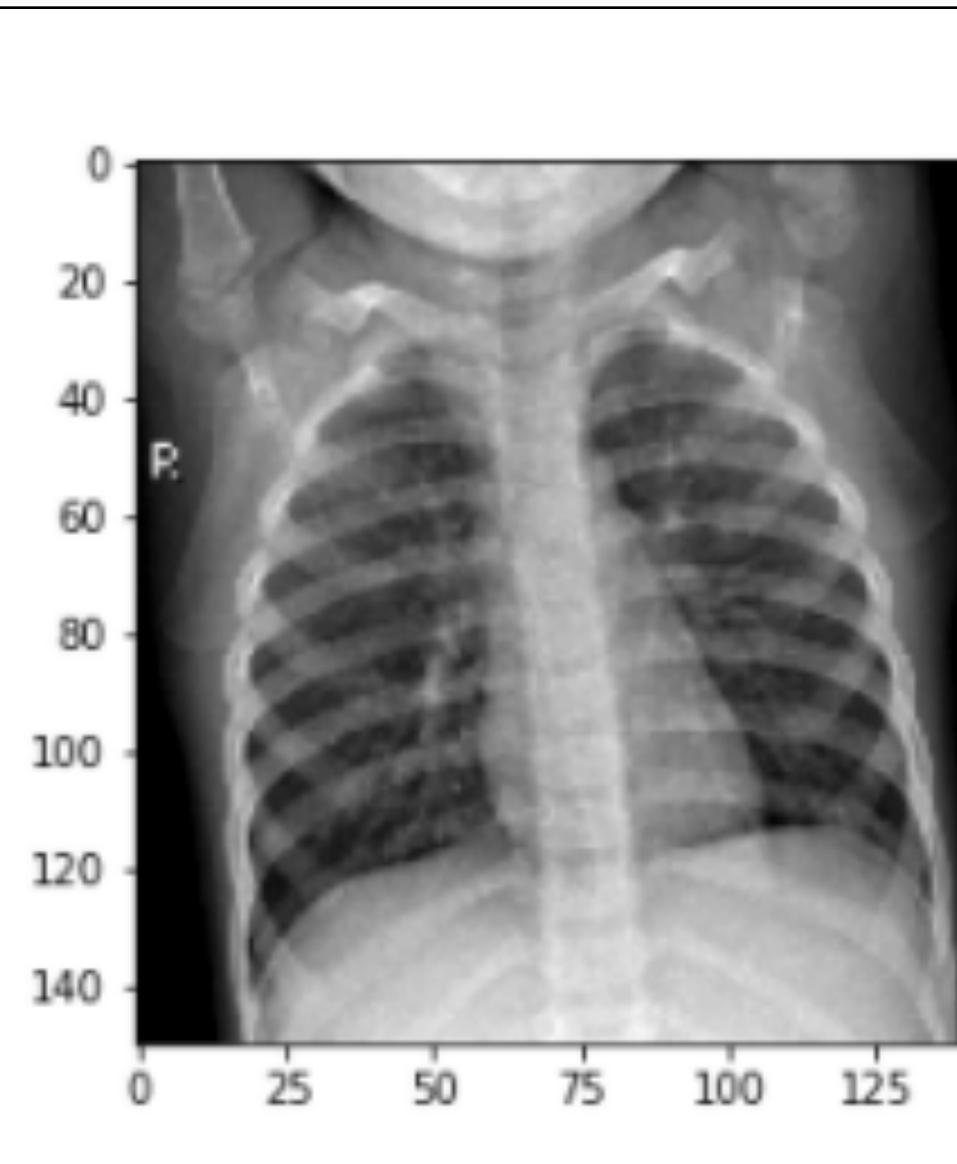
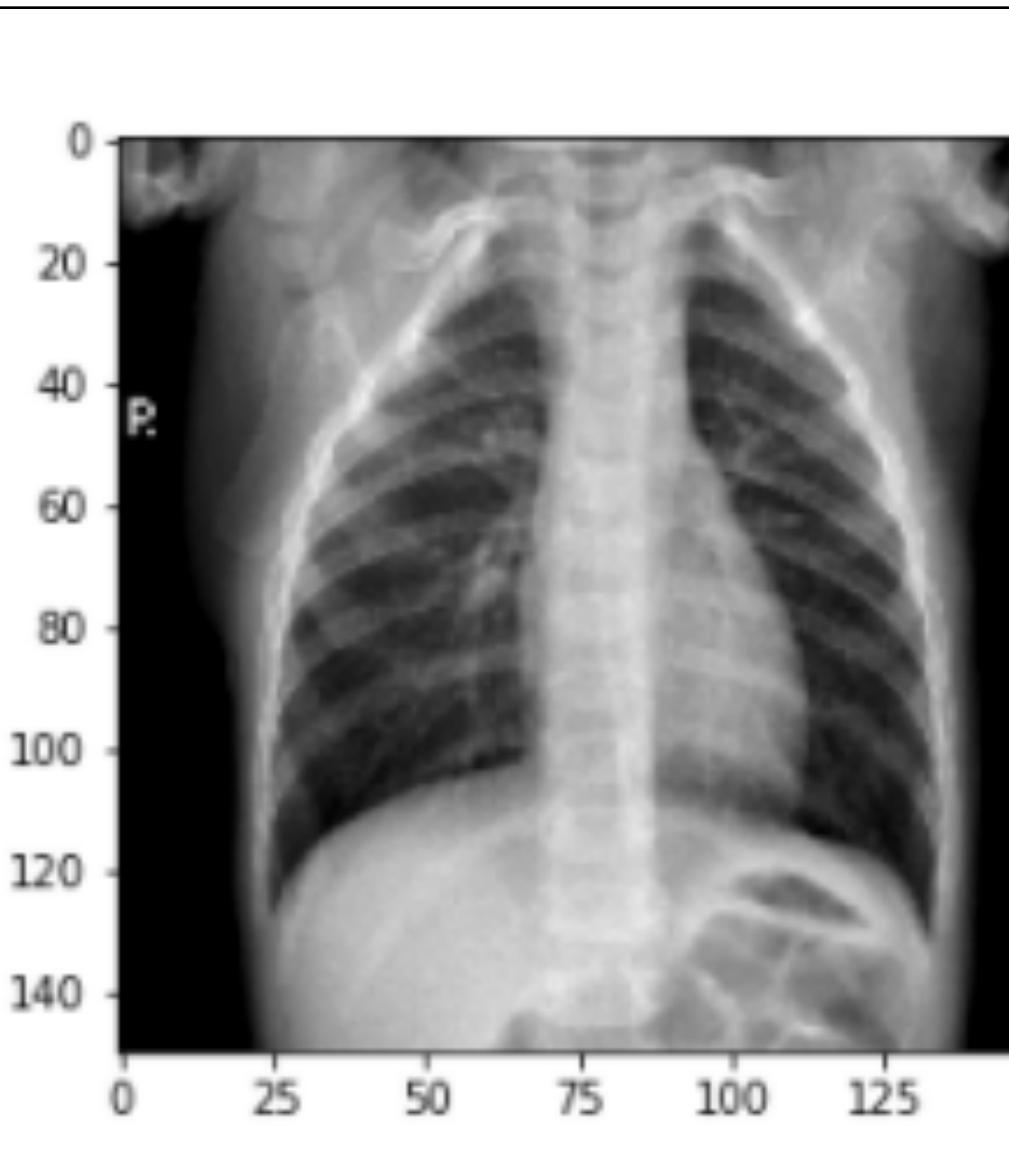
RESULTS

X-RAY IMAGE MATRIX

Predicted Outcome

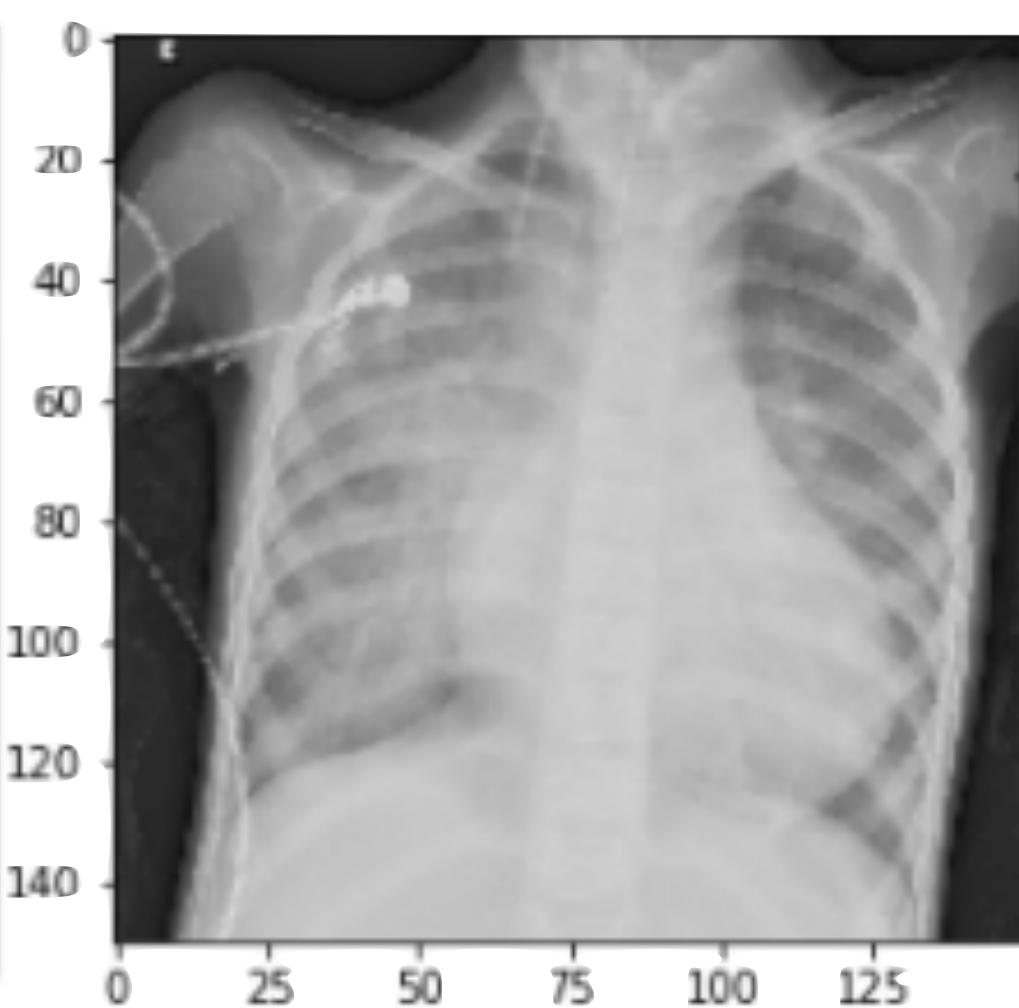
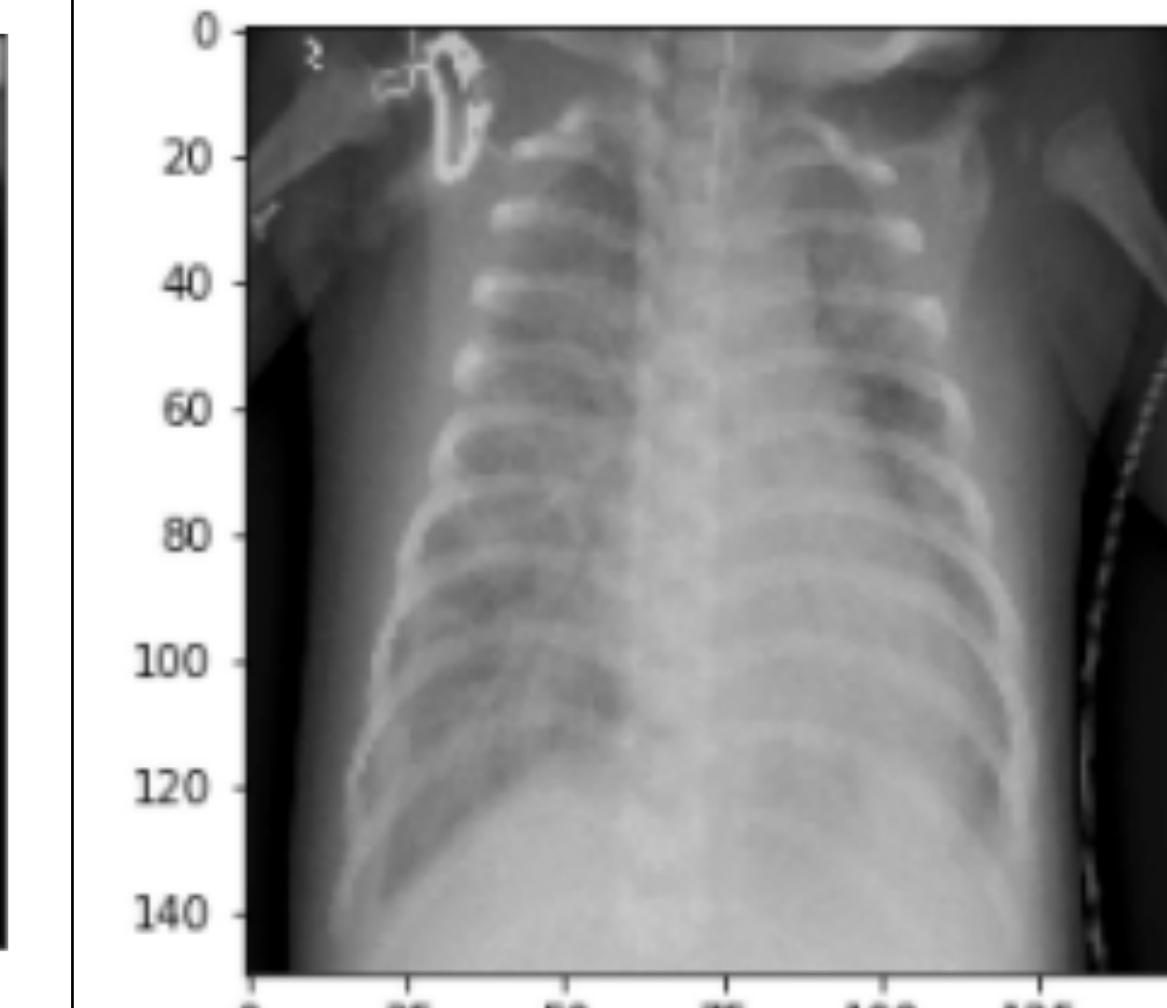
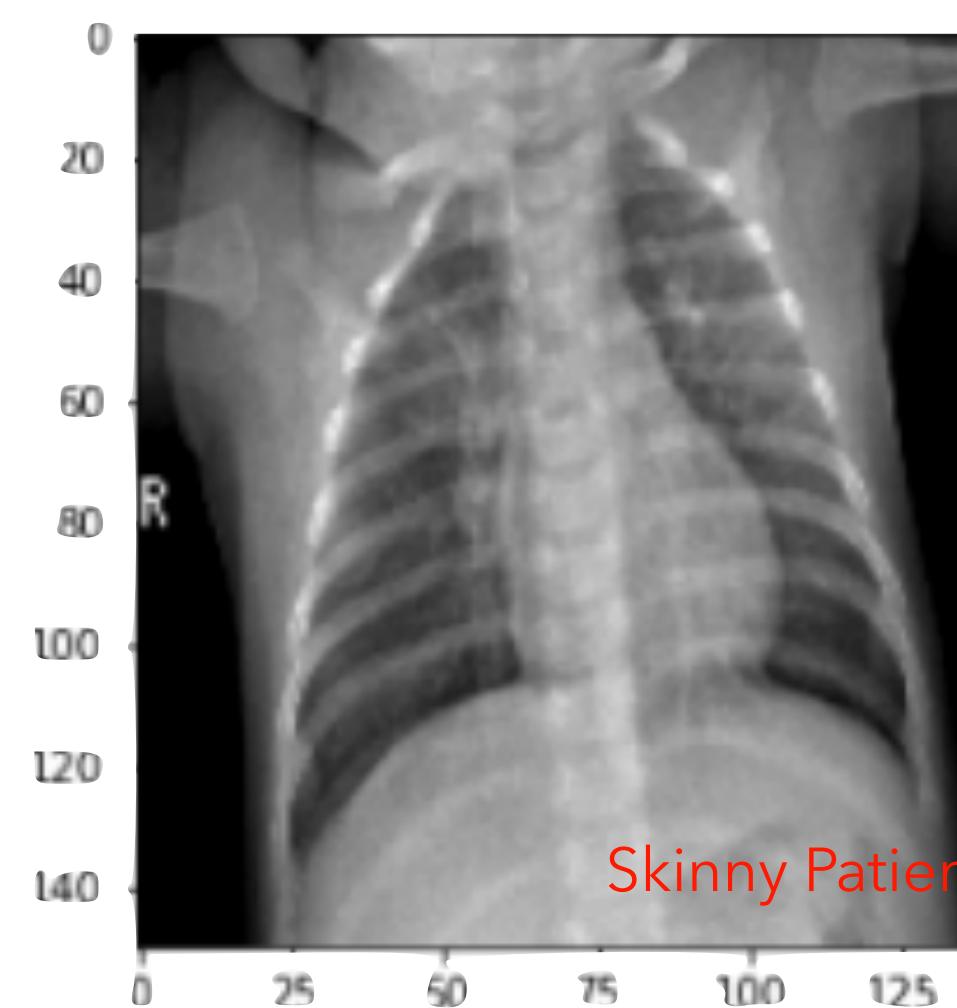
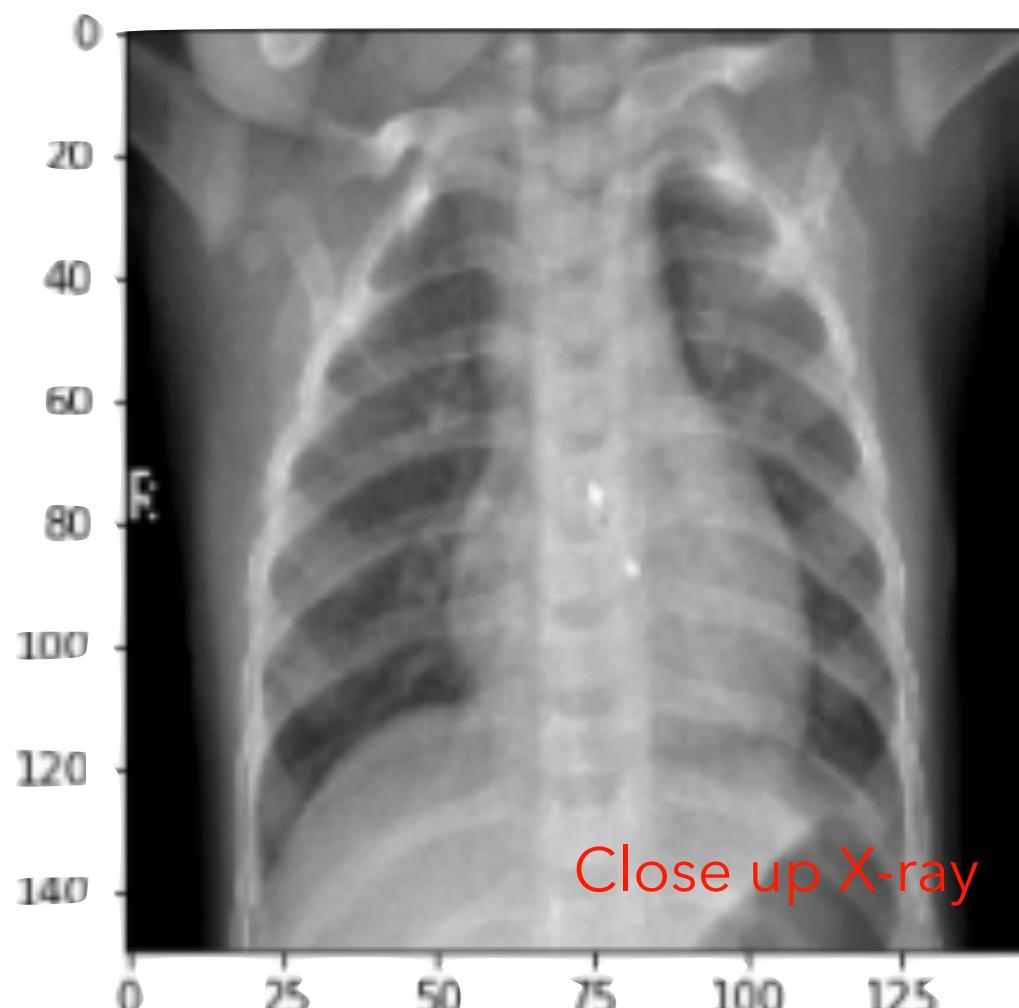
Actual Outcome

Normal



Pneumonia

Normal

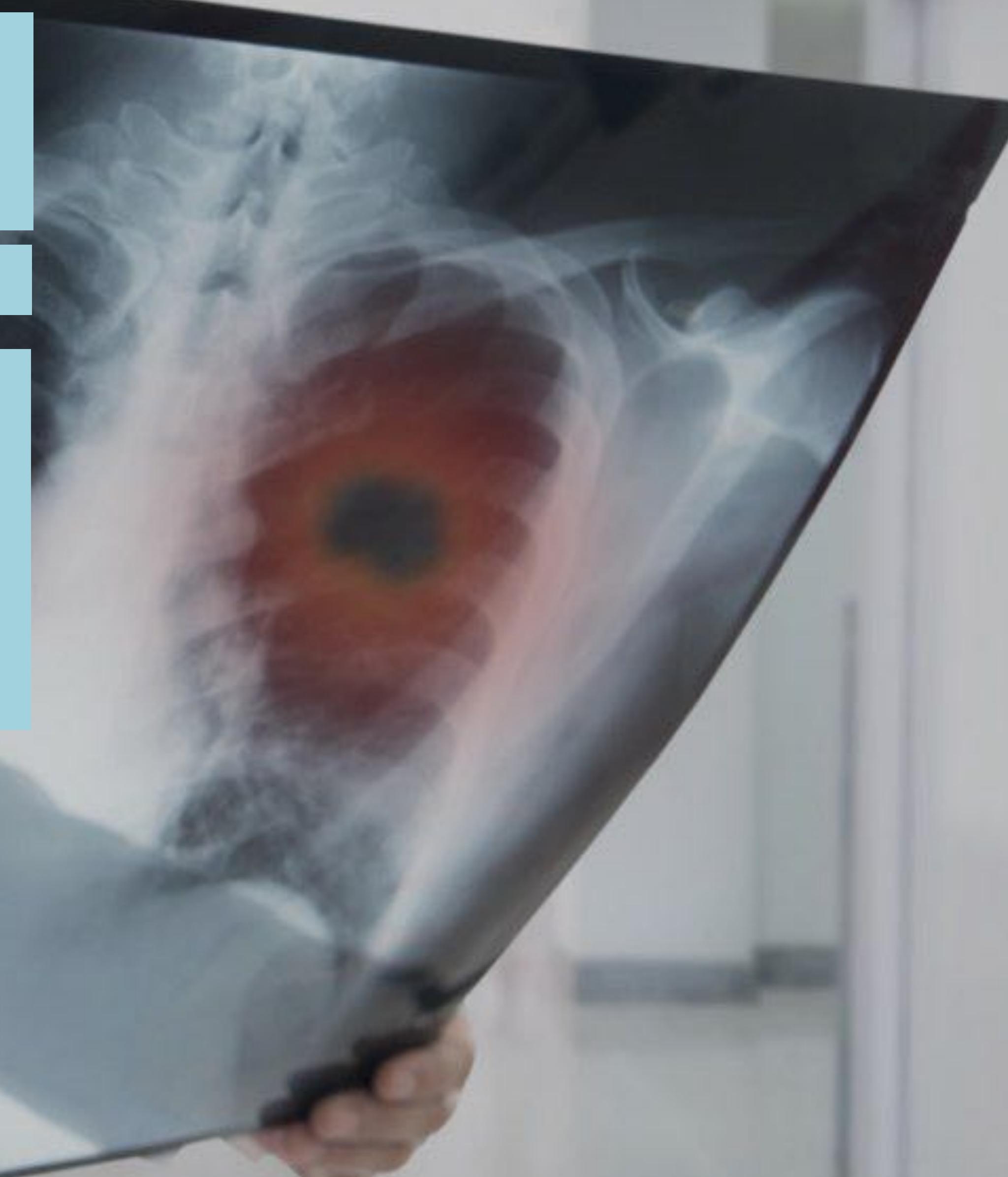


Pneumonia

CONCLUSIONS

MODELS & ANALYSIS

- Good performance of the chosen model on both test datasets
- Consistency of performance with MobileNet model in both cases



FUTURE WORK

- Implementation of extra regularization on defined models
- Make use of additional transfer learning from pre-trained models