Lung Disease Classification

with LungNet22 and EfficientNetV2

DATA 586 - Group 13

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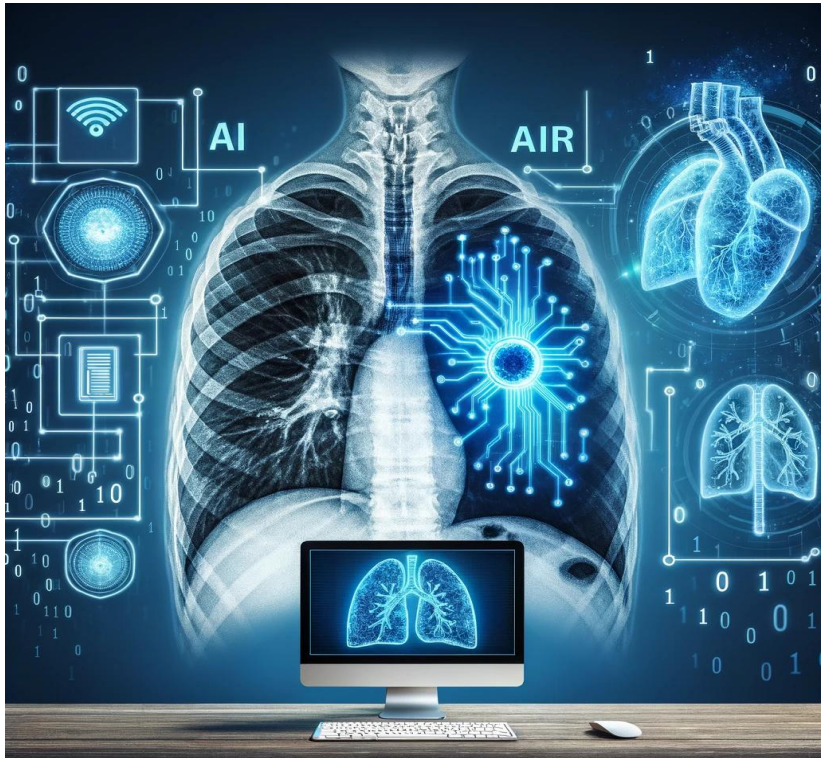
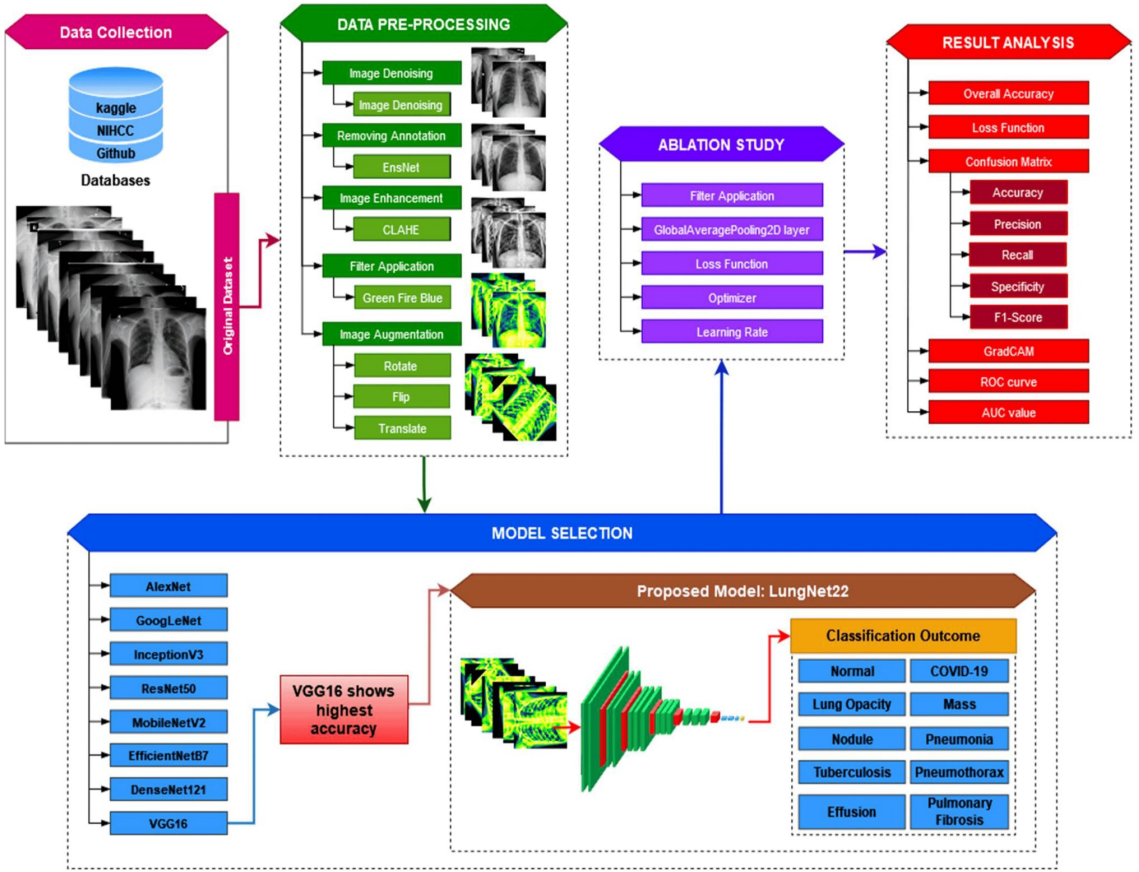
The Growing Need for AI-powered Lung Disease Classification

Traditional

AI



LungNet22: A Fine-Tuned Model for Multiclass Classification and Prediction of Lung Disease Using X-ray Images



Accuracies

96.47% training
97.03% validation
98.89% testing

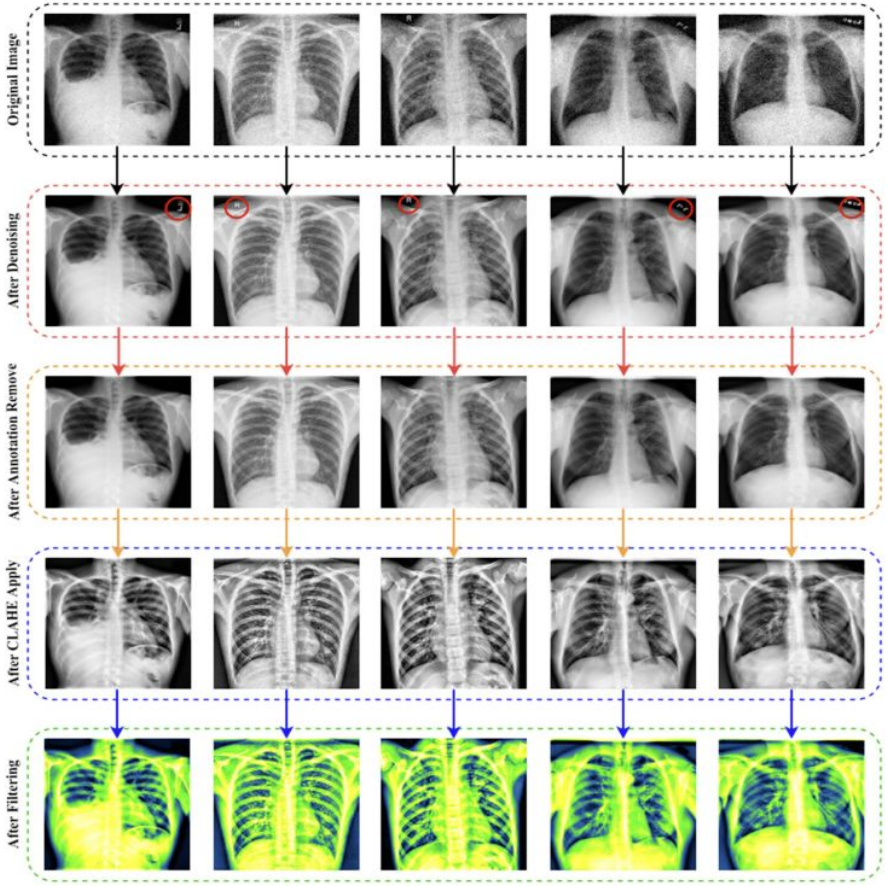
Data Preprocessing

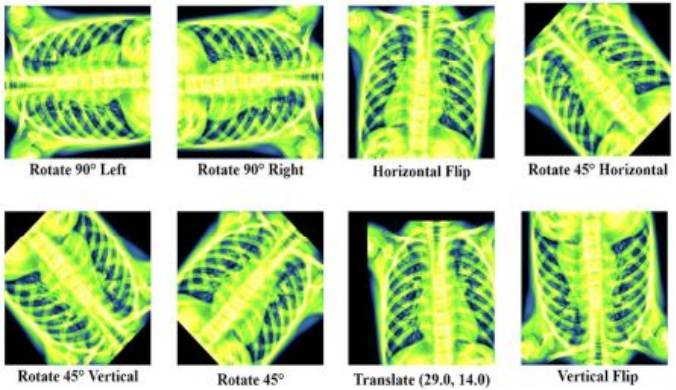
Denoising

EnsNet

CLAHE

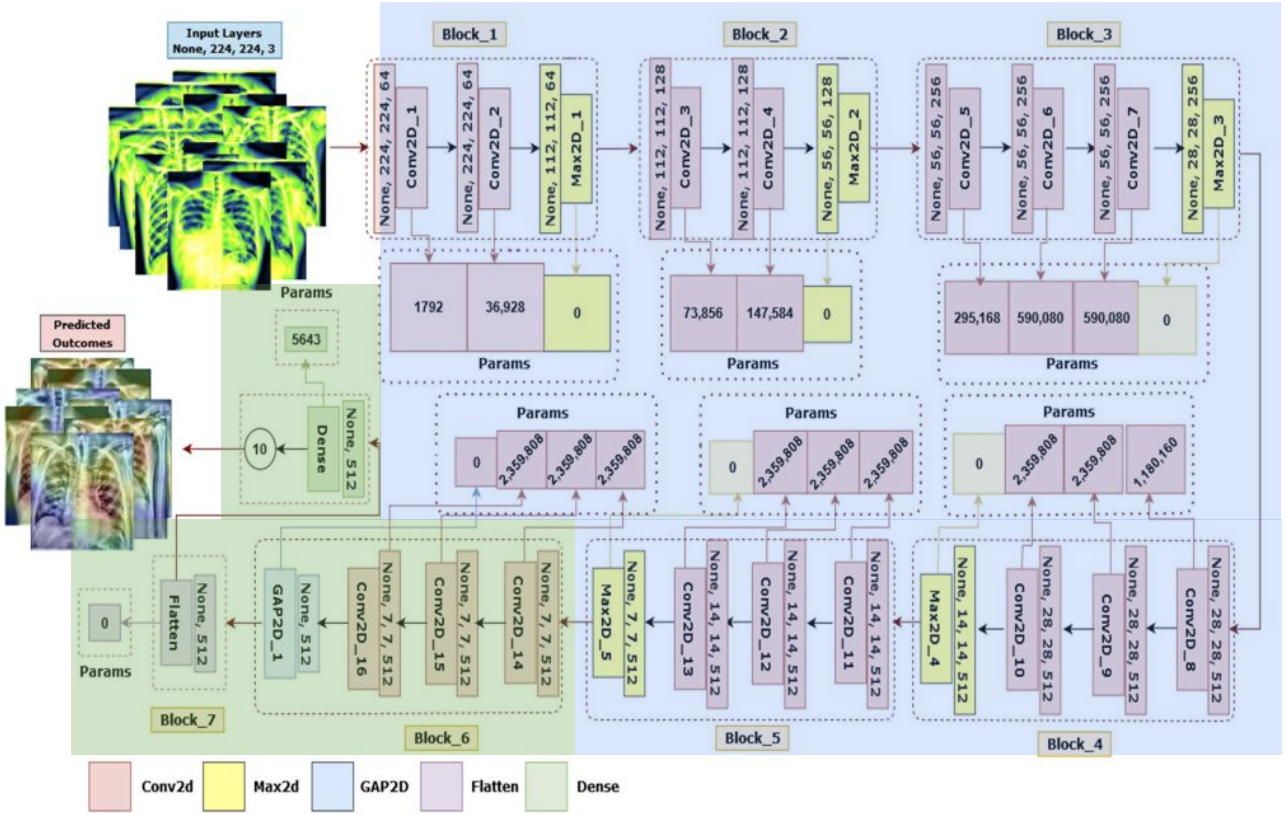
Green Fire Blue





Augmentation

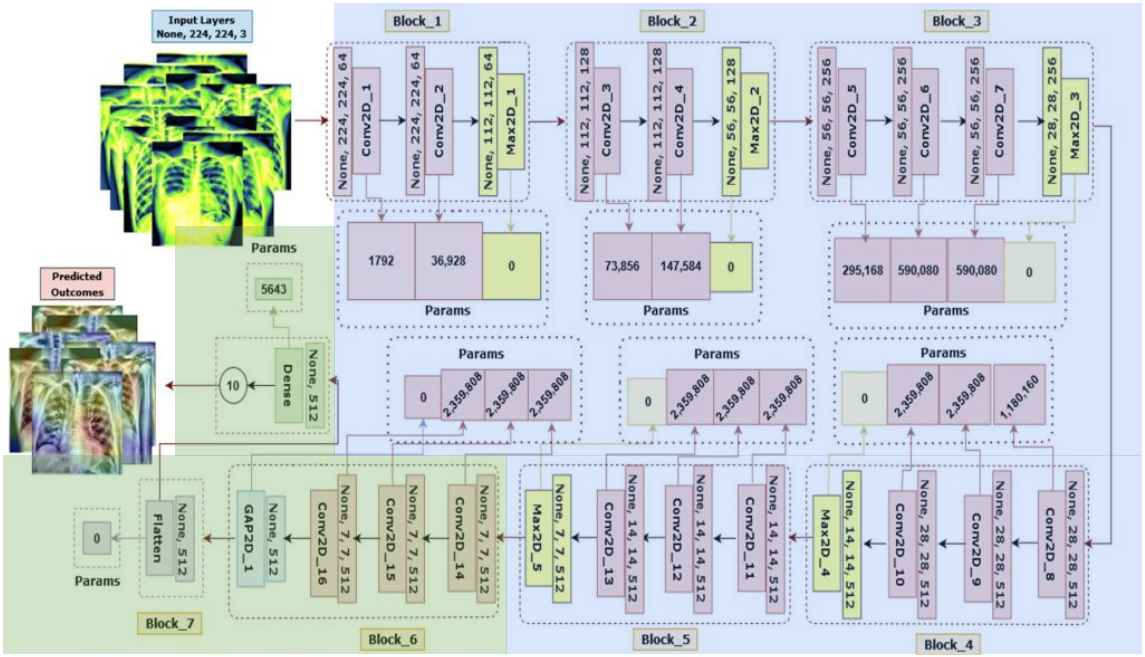
Model Architecture (LungNet22)



Pre-trained VGG16

Additional blocks of VGG16

Our Goals



Experiment Optimizer
Adam vs AdamW

3

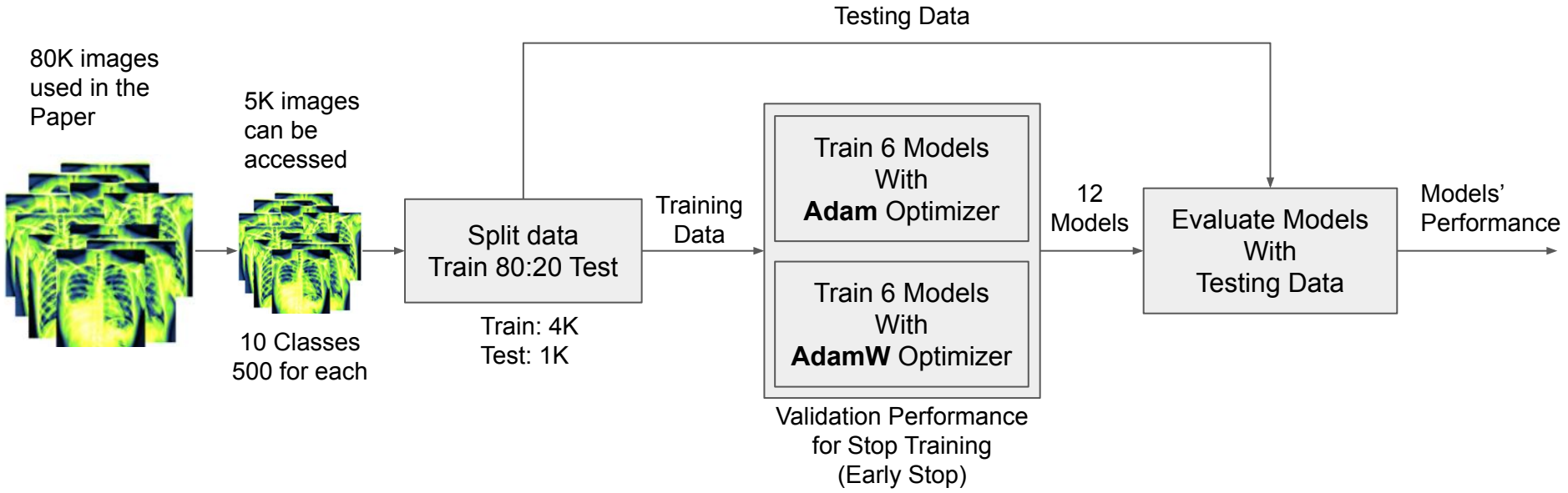
Replicate the Paper
VGG16

1

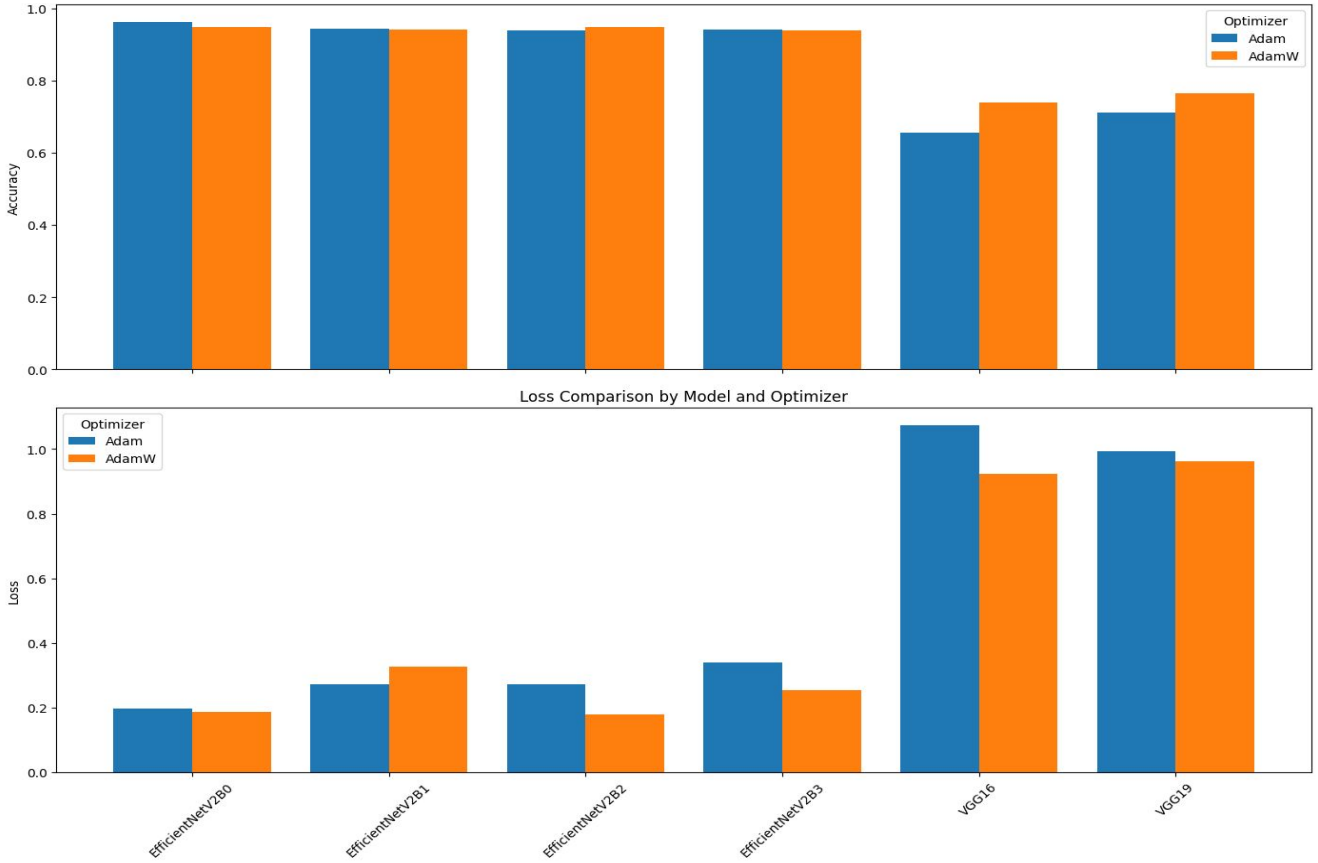
Explore other Architectures
EfficientNetV2B0
EfficientNetV2B1
EfficientNetV2B2
EfficientNetV2B3
VGG19

2

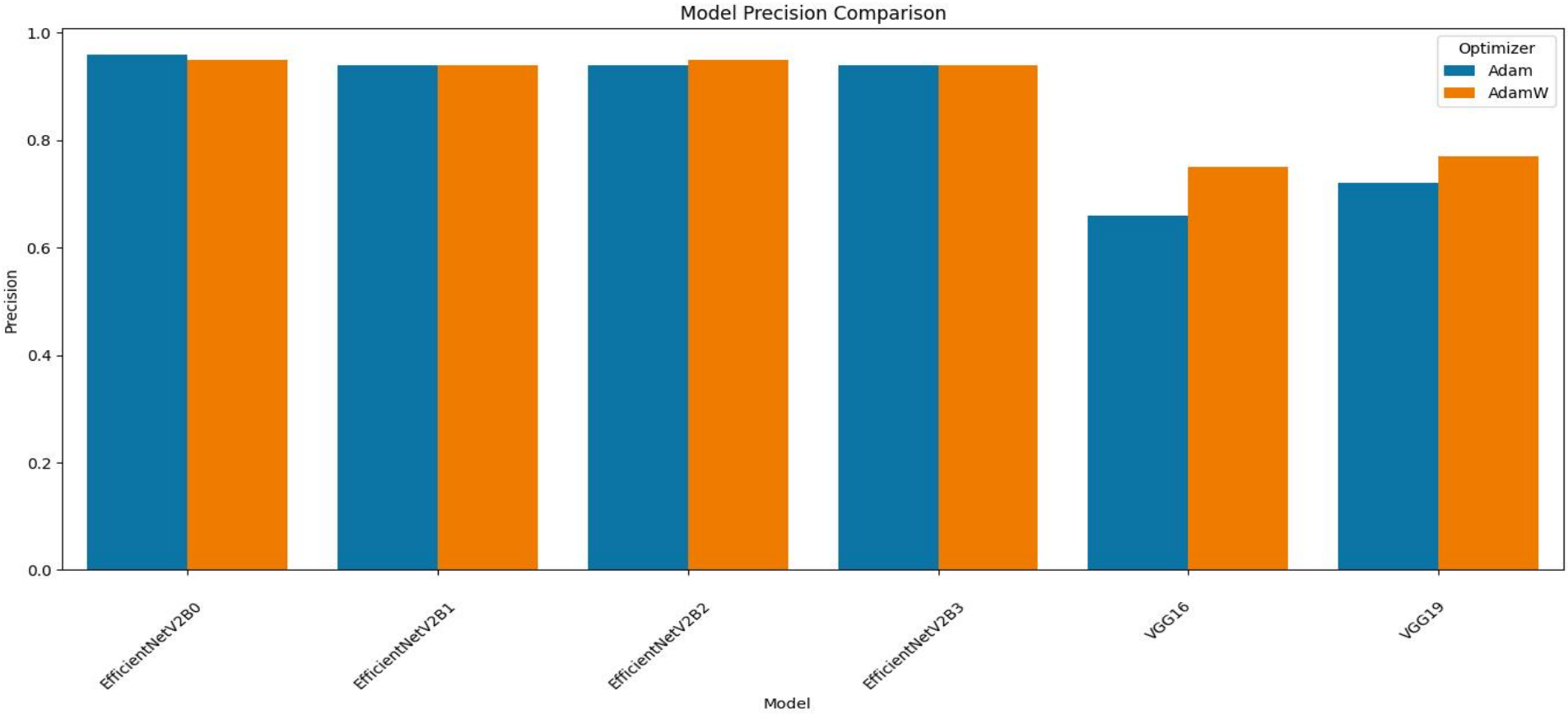
Workflow


Testing Data
80K images used in the Paper
5K images can be accessed
10 Classes
500 for each
Split data
Train 80:20 Test
Train: 4K
Test: 1K
Training Data
Train 6 Models With **Adam** Optimizer
Train 6 Models With **AdamW** Optimizer
Validation Performance for Stop Training (Early Stop)
12 Models
Evaluate Models With Testing Data
Models' Performance

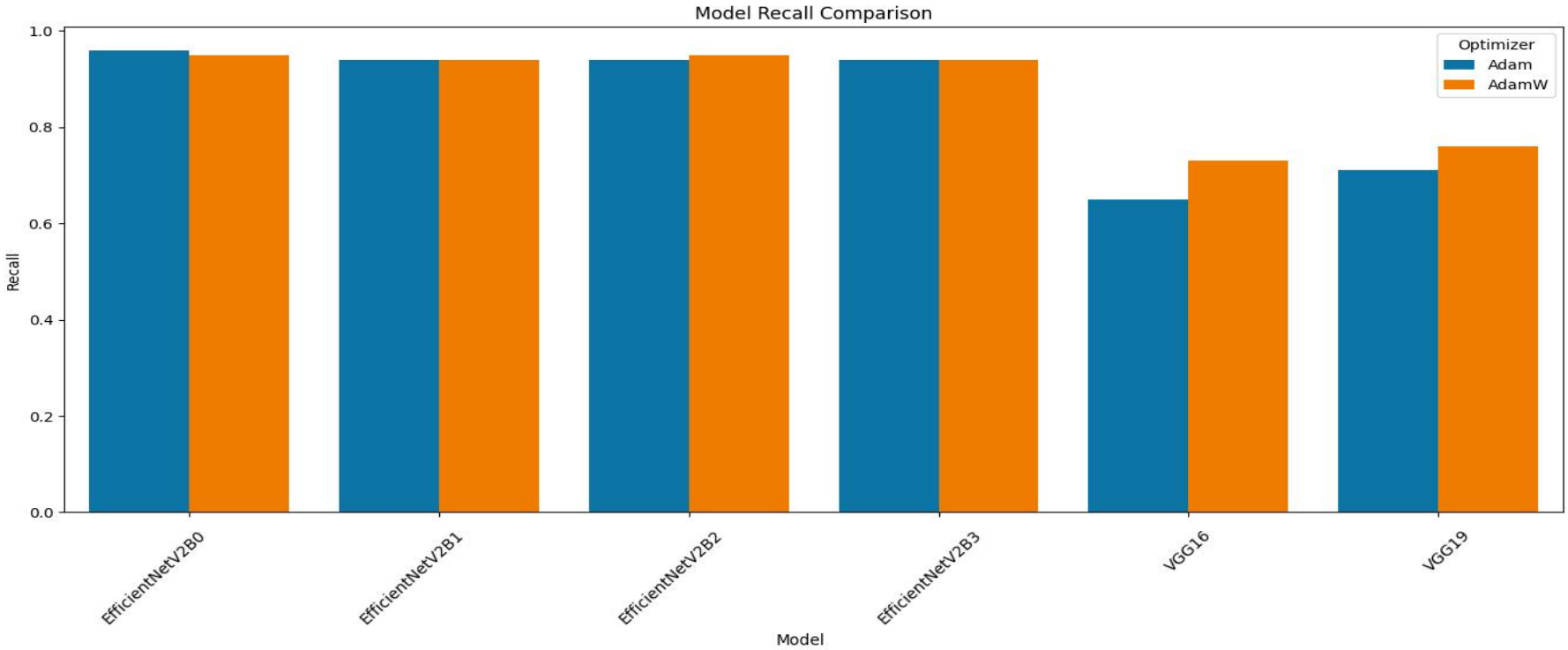
Model's Performance - Accuracy



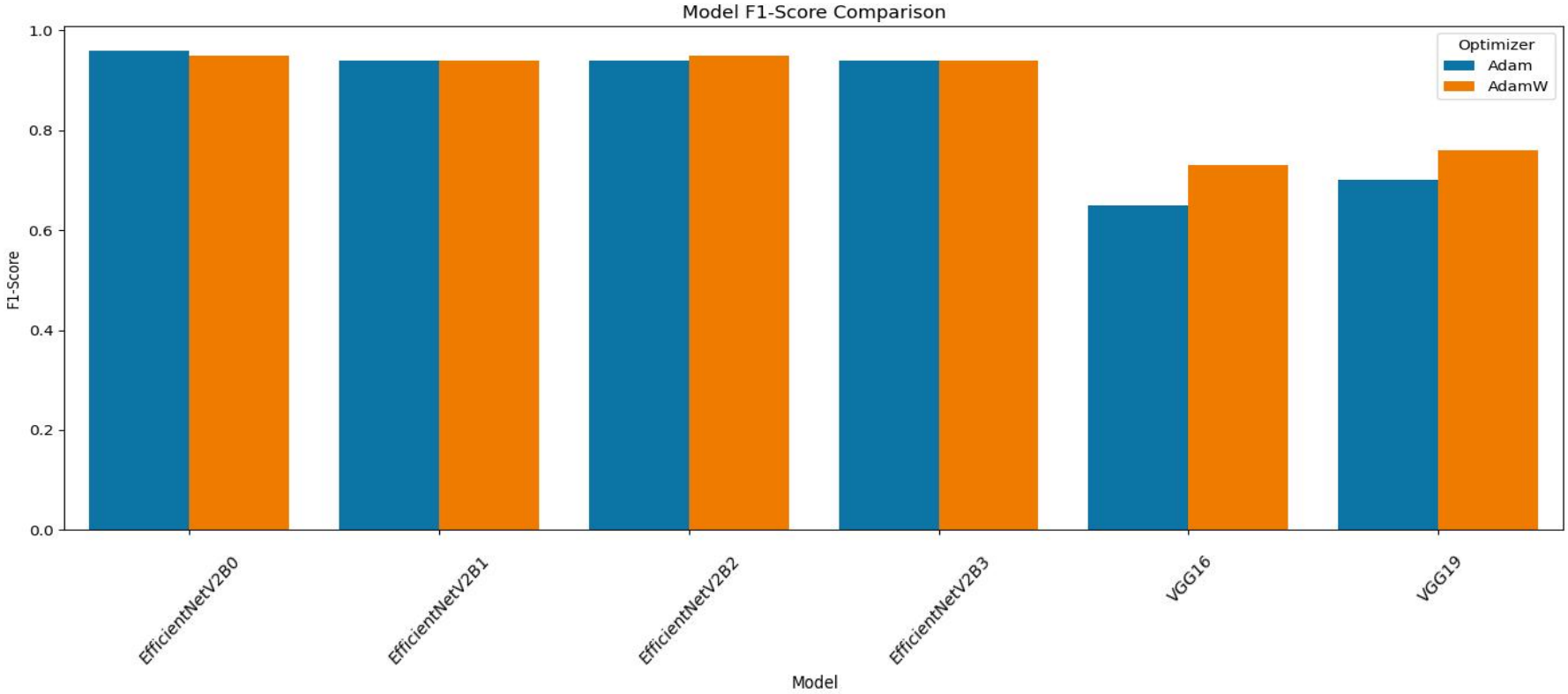
Model's Performance - Precision



Model's Performance - Recall

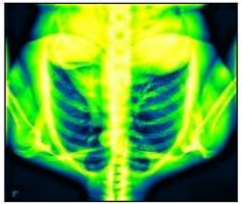


Model's Performance - F1-Score

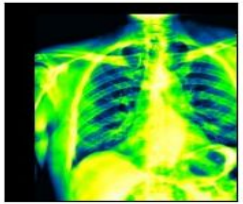


X-Ray Test Images

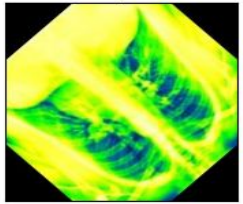
True: pneumothorax
Predicted: pneumothorax



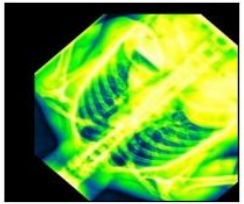
True: nodule
Predicted: nodule



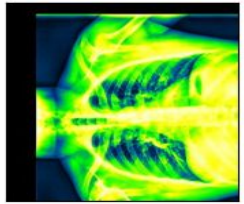
True: pneumonia
Predicted: pneumonia



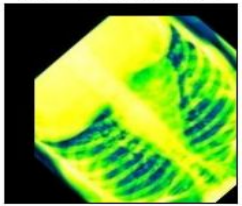
True: control
Predicted: control



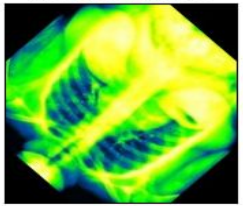
True: control
Predicted: control



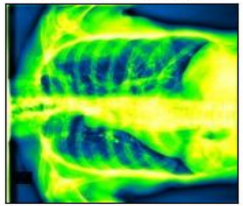
True: nodule
Predicted: nodule



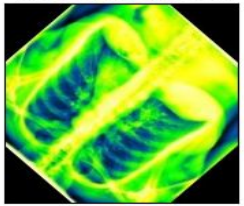
True: mass
Predicted: mass



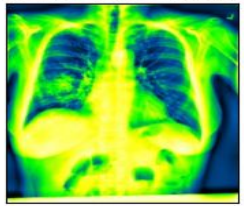
True: mass
Predicted: mass



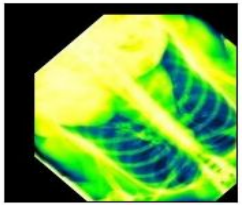
True: effusion
Predicted: effusion



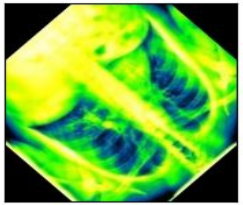
True: pneumonia
Predicted: pneumonia



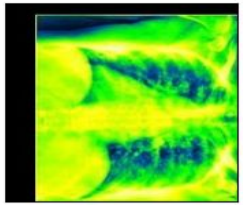
True: nodule
Predicted: nodule



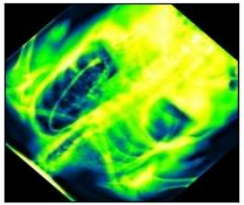
True: effusion
Predicted: effusion



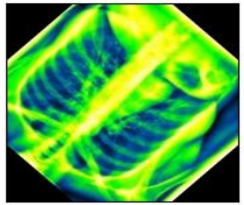
True: covid
Predicted: covid



True: effusion
Predicted: effusion



True: pneumonia
Predicted: pneumonia



Key Findings

- Successful replication of the original paper's results.
- EfficientNetV2 performs better than VGG in general.
- AdamW optimizer performs significantly better than Adam in VGG.
- Adam and AdamW performs similarly when EfficientNetV2 is used.

Limitations and Future work

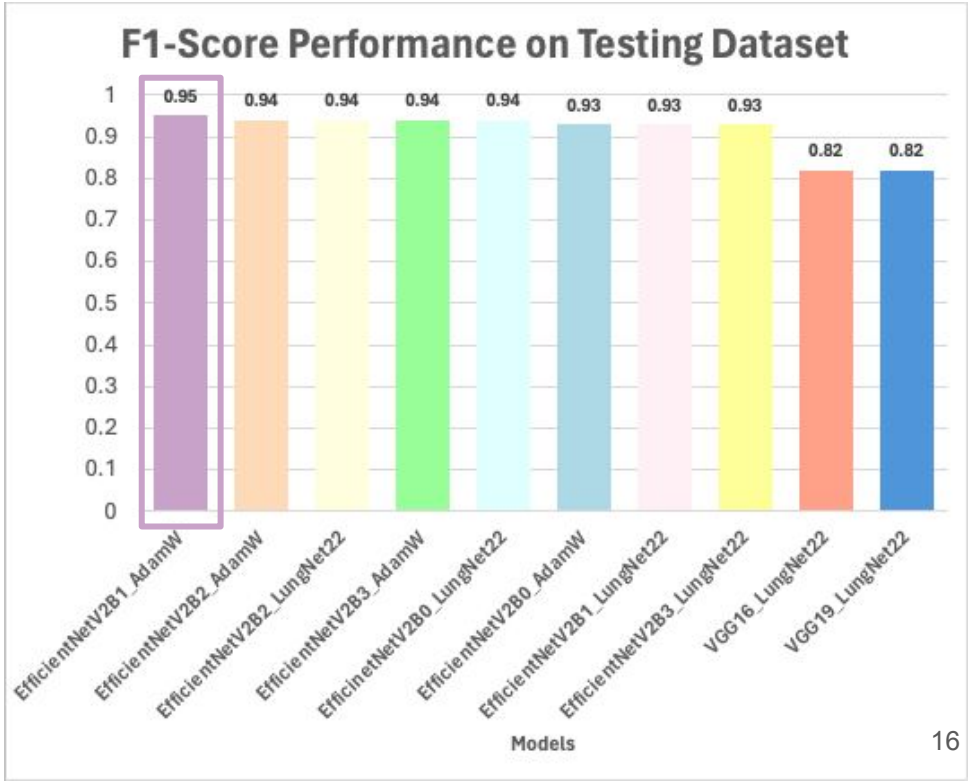
- Preprocessing of images
- Dataset size
- Hardware - GPU
- Different pretrained models

Thank You

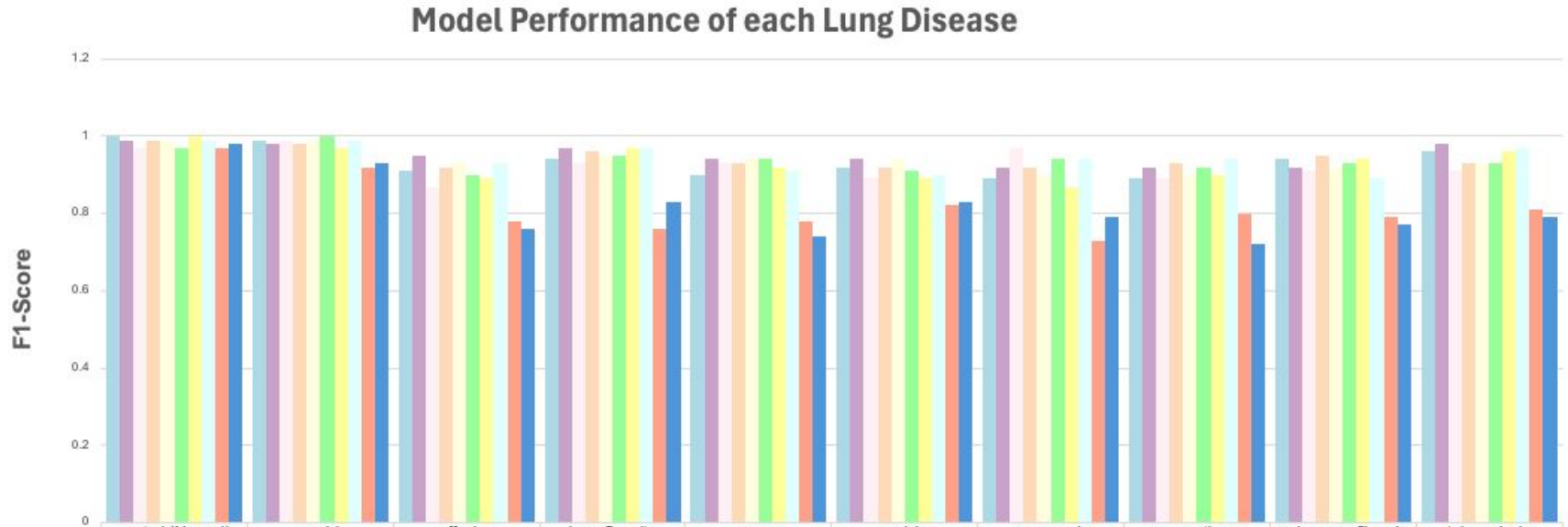
Question?

Performance Evaluation - Overall

- F1-Score
- Highlight the best performing model **EfficientNetV2B1 with AdamW optimizer.**
- Briefly discuss the performance of other models (e.g., EfficientNet variants, LungNet22)



Performance Evaluation - Each Lung Disease



	control (Normal)	covid	effusion	lung Opacity	mass	nodule	pneumonia	pneumothorax	pulmunary fibrosis	tuberculosis
EfficientNetV2B0_AdamW	1	0.99	0.91	0.94	0.9	0.92	0.89	0.89	0.94	0.96
EfficientNetV2B1_AdamW	0.99	0.98	0.95	0.97	0.94	0.94	0.92	0.92	0.92	0.98
EfficientNetV2B1_LungNet22	0.97	0.99	0.87	0.93	0.93	0.89	0.97	0.89	0.91	0.91
EfficientNetV2B2_AdamW	0.99	0.98	0.92	0.96	0.93	0.92	0.92	0.93	0.95	0.93
EfficientNetV2B2_LungNet22	0.99	0.99	0.93	0.95	0.94	0.94	0.9	0.9	0.92	0.93
EfficientNetV2B3_AdamW	0.97	1	0.9	0.95	0.94	0.91	0.94	0.92	0.93	0.93
EfficientNetV2B3_LungNet22	1	0.97	0.89	0.97	0.92	0.89	0.87	0.9	0.94	0.96
EfficinetNetV2B0_LungNet22	0.99	0.99	0.93	0.97	0.91	0.9	0.94	0.94	0.89	0.97
VGG16_LungNet22	0.97	0.92	0.78	0.76	0.78	0.82	0.73	0.8	0.79	0.81
VGG19_LungNet22	0.98	0.93	0.76	0.83	0.74	0.83	0.79	0.72	0.77	0.79