COVID-19 Detection from CT Scan Images Using Pre-Trained CNN Models

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Introduction

- WHO declared COVID-19 as a global pandemic on March 11, 2020 [1]
- COVID-19 has infected 646.3 M people and taken 6.6 M lives [2]
- Patients with other diseases suffer more than those who are healthy
- RT-PCR test which is widely used for diagnosis is very time-consuming
- Chest CT scan screening requires the intervention of expert radiologists
- Deep learning can be used to build a fast and accurate detection system

Overview

- We have used a lung CT Scan Image dataset for the recognition task
- We have utilized some pre-trained CNN models for COVID-19 detection
- We have evaluated the models with different performance metrics
- We have explored the performance of the models used in previous studies

Literature Review

Maghdid et al. [3]

- 526 samples
- AlexNet model
- 94.1% accuracy

Showkat et al. [4]

- 5910 samples
- ResNet18 model
- 95% accuracy

Shah et al. [5]

- 738 samples
- Ctnet-10 model
- 82.1% accuracy

Panwar et al. [6]

- 284 samples
- nCOVnet model
- 88% accuracy

Shalbaf et al. [7]

- 746 samples
- Ensemble technique
- 85% accuracy

Pre-Trained Models

ResNet50

- 50 layers
- 76.3% accuracy
- Fewer parameters

Xception

- 71 layers
- Depthwise separable
- Fewer parameters

DenseNet121

- Densely connected
- Remove vanishing gradient
- Reuse features

Pre-Trained Models

DenseNet201

- 201 layers
- Fewer parameters
- Reuse features

MobileNet

- 28 layers
- 4.2 M parameters
- Smaller size

MobileNetV2

- Inverted residual blocks
- Bottleneck residual blocks
- Fewer parameters

Dataset

Class	No. of Samples
COVID	1252
Non-COVID	1230

Figure: COVID-positive samples

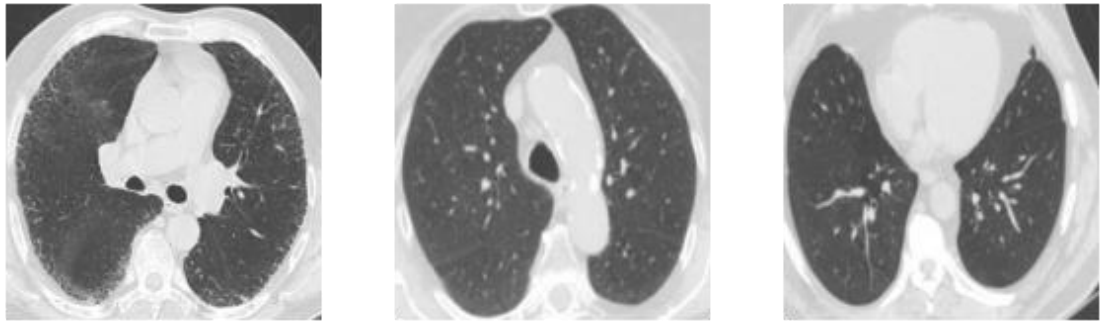
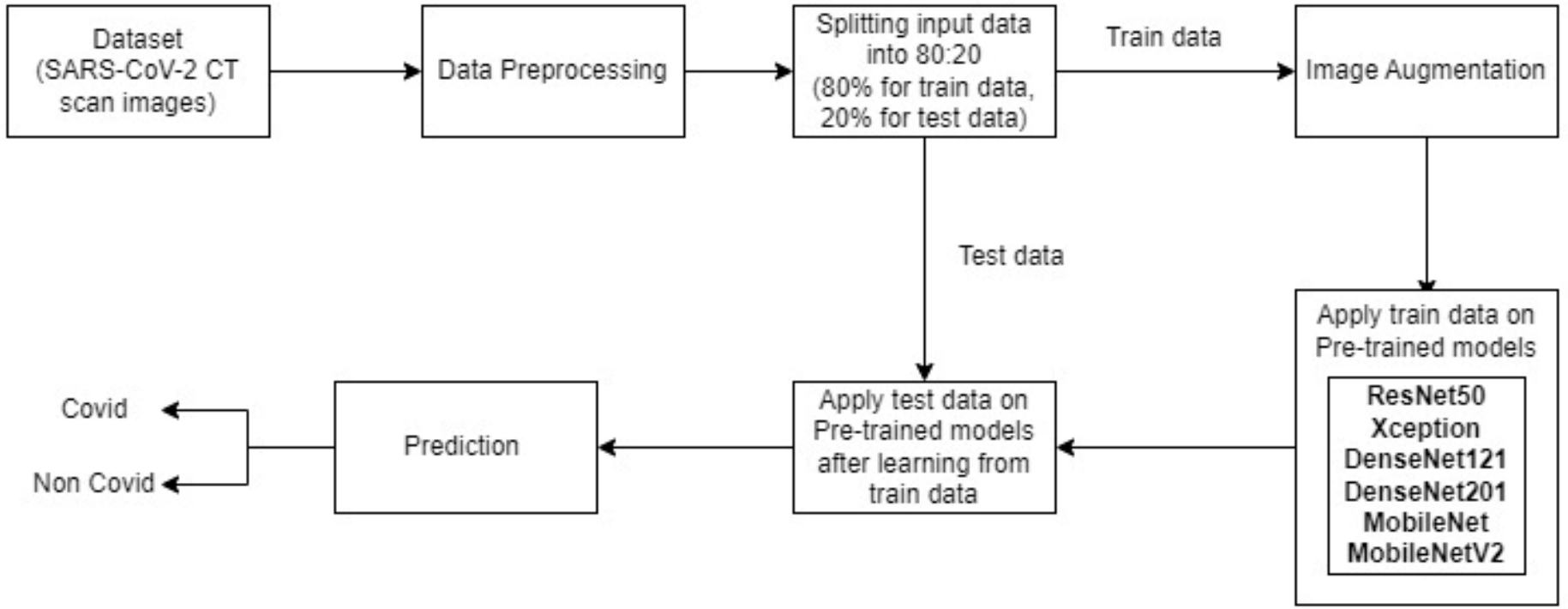


Figure: COVID-negative samples

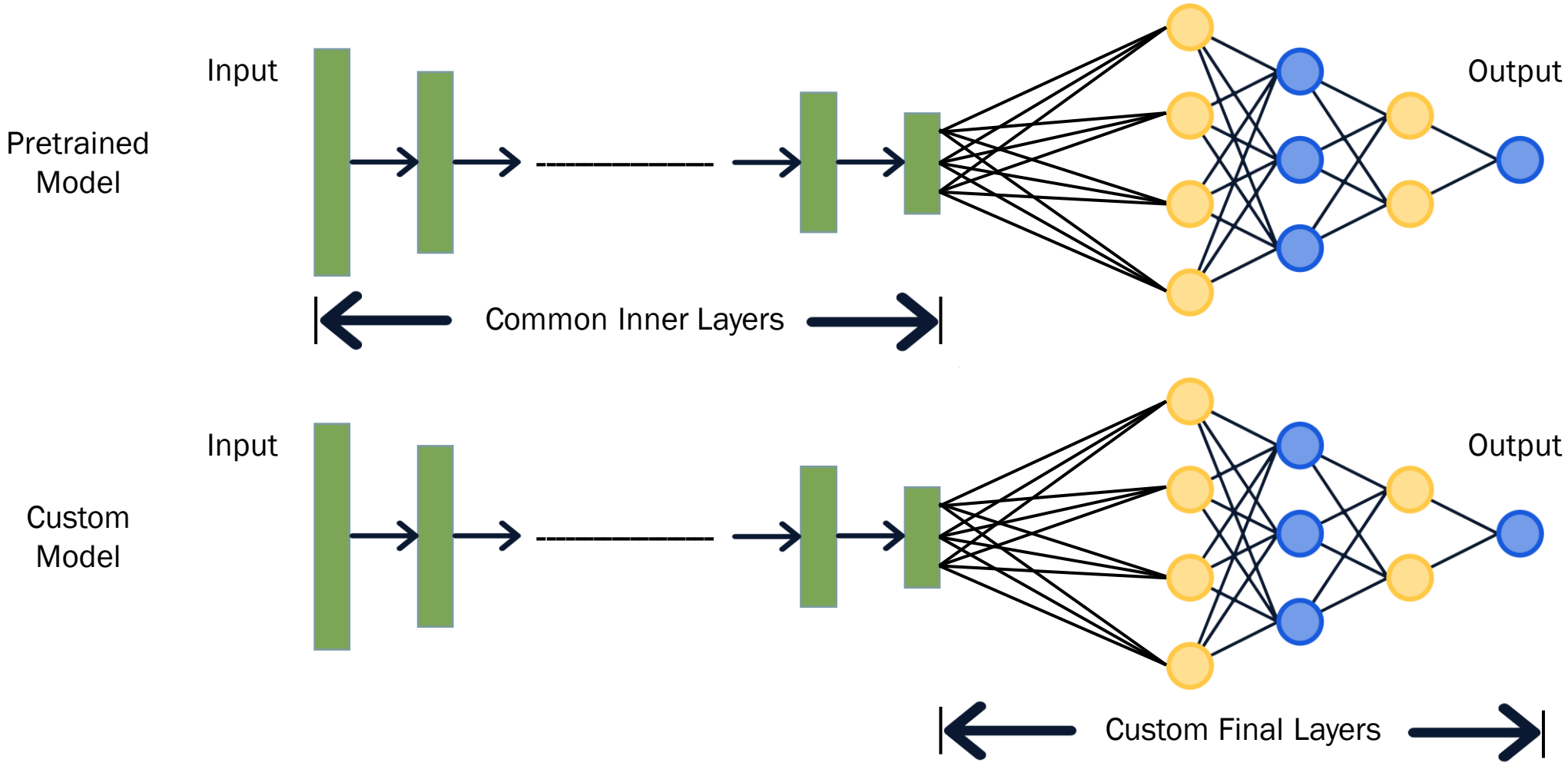
Methodology



Methodology

Model	Dropout Rate	Learning Rate
ResNet50	0.2	0.001
Xception	0.2	0.001
DenseNet121	0.2	0.001
DenseNet201	0.3	0.001
MobileNet	0.5	0.001
MobileNetV2	0.5	0.001

Proposed CNN



Results & Performance

Model	Accuracy	Precision	Recall	F1-Score
ResNet50	**95.97%**	**96.23%**	94.44%	**95.33%**
Xception	88.10%	80.08%	**96.76%**	87.63%
DenseNet121	95.56%	93.69%	96.30%	94.98%
DenseNet201	95.77%	94.12%	96.30%	95.20%
MobileNet	93.15%	93.75%	90.28%	91.98%
MobileNetV2	92.74%	91.28%	92.13%	91.70%

Performance Comparison

Methodology	Accuracy
Shah et al. [5]	82.1%
Panwar et al. [6]	88%
Shalbaf et al. [7]	85%
Proposed Model	95.97%

Conclusion

- RT-PCR test is not reliable due to the amount of time it takes
- Deep learning is widely used for medical image processing
- Pre-trained CNN models can accurately detect the presence of the virus
- ResNet50 performed the best with 95.97% accuracy
- The current method can be useful for other medical image classification

References

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Thank You