

Segmentation of Lung Lobes and Lesions for Severity Classification of COVID-19 CT scans

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Lung computed tomography (CT) severity score can be used for predicting clinical outcomes of patient with COVID-19. In this study, we propose a deep learning semantic segmentation for lung severity scoring of COVID-19 infection using the combination of 3D-UNet and pre-trained models, DenseNet and ResNet.

Objectives

- 01** To apply deep learning technology for lung lobes and lesions segmentation of COVID-19 CT scans.
- 02** To create user interface that could help radiologists assess lung involvement and classify the severity of COVID-19.

Technologies



TensorFlow



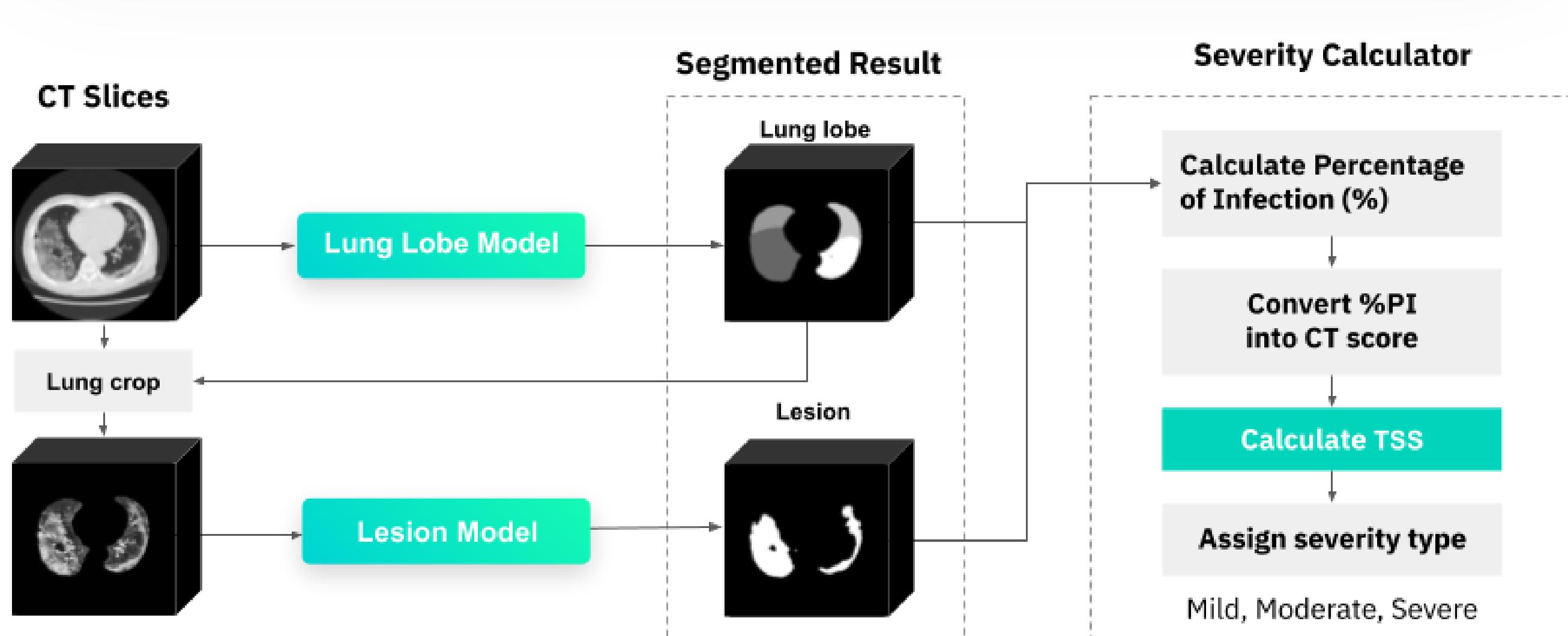
colab

K Keras



Method

The segmentation model was trained with axial CT scans of 32 COVID-19 patients (training: 24, validation: 8) and tested with CT dataset of 8 patients. Next, the segmented masks were used to calculate the percentage of infection (PI), Total Severity Score (TSS) and define severity type. Lastly, correlation between model-predicted vs radiologist TSS was analyzed using CT scans of 62 patient.



Result

Model Structure:
3D-UNet + DenseNet 169

Lung Lobe Model

93%

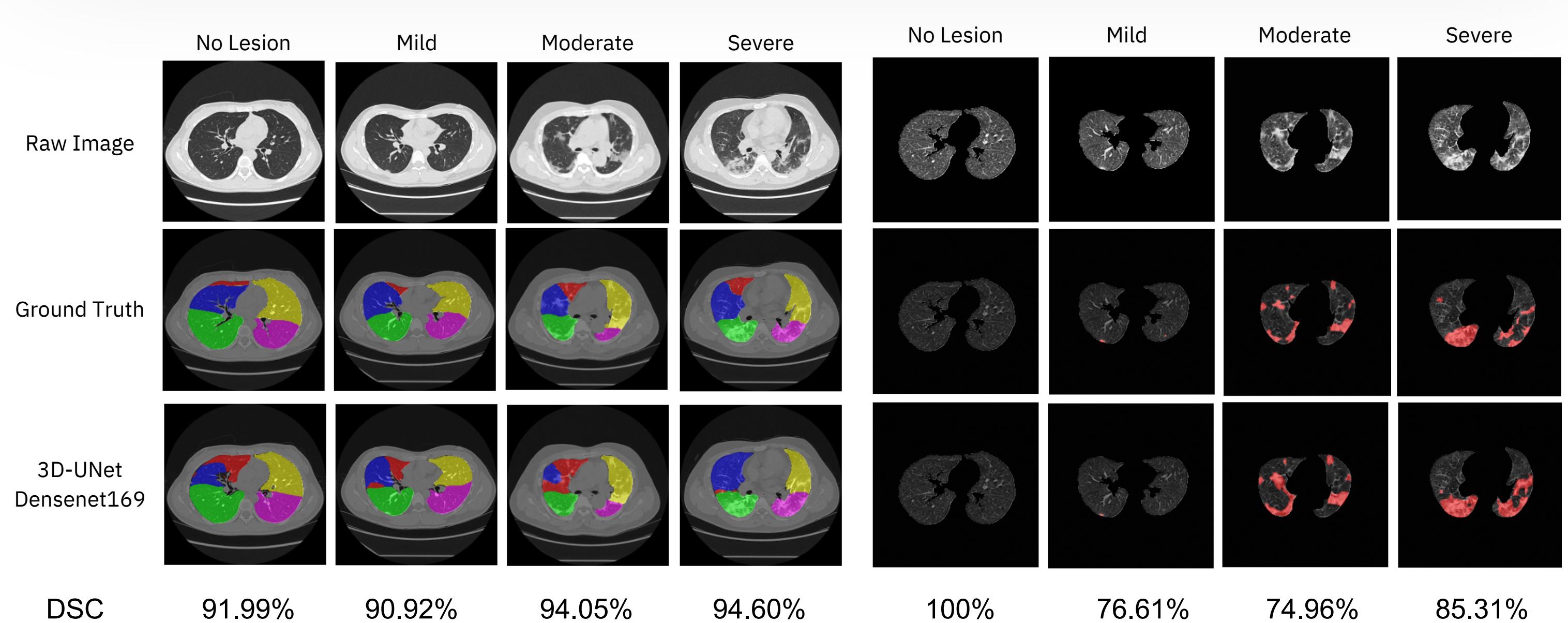
Lesion Model

84%

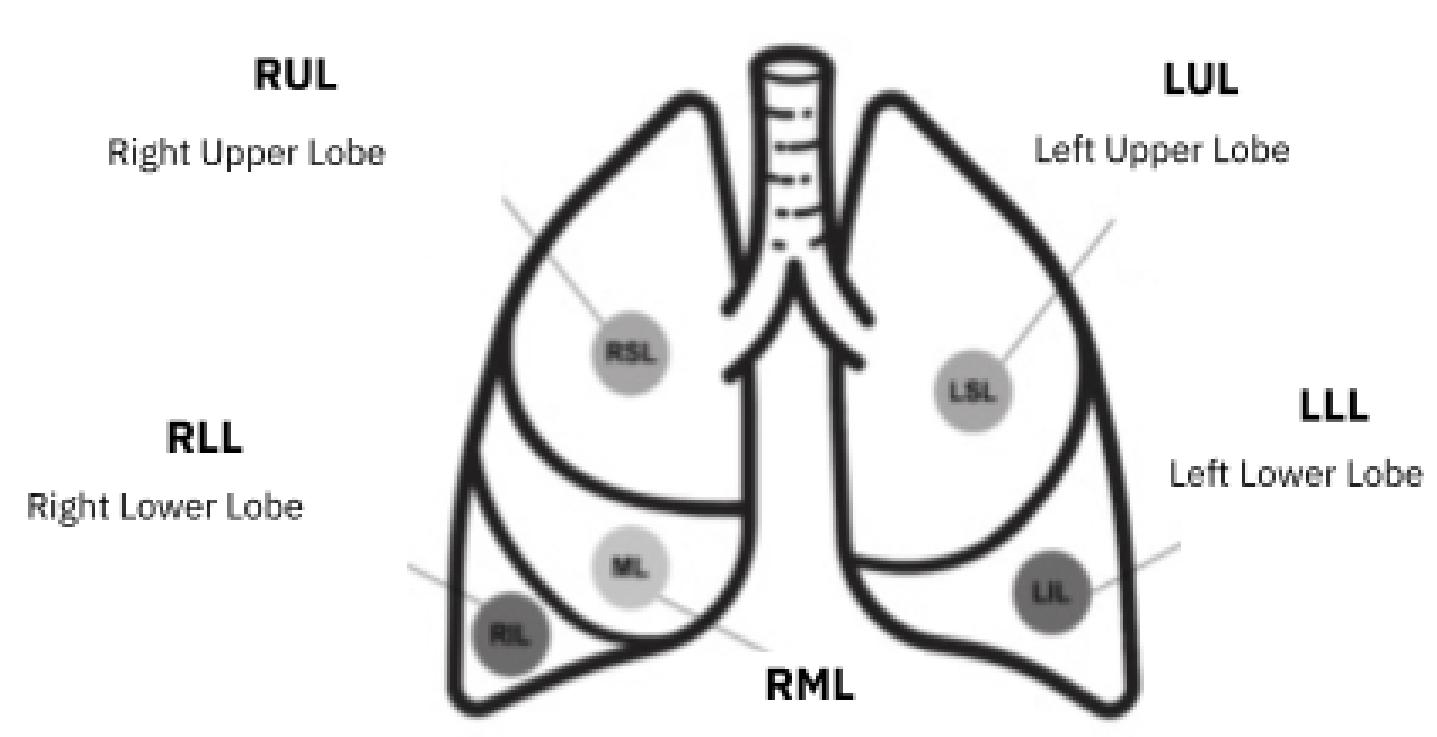
DSC: Dice Similarity Coefficient

Model-predicted vs Radiologist TSS

Regression Statistics	
Correlation Coefficient	0.9125
R square	0.8327
Observations	62
P-value	< 0.01



Total Severity Score (TSS) is the Sum of Individual Lobar score.

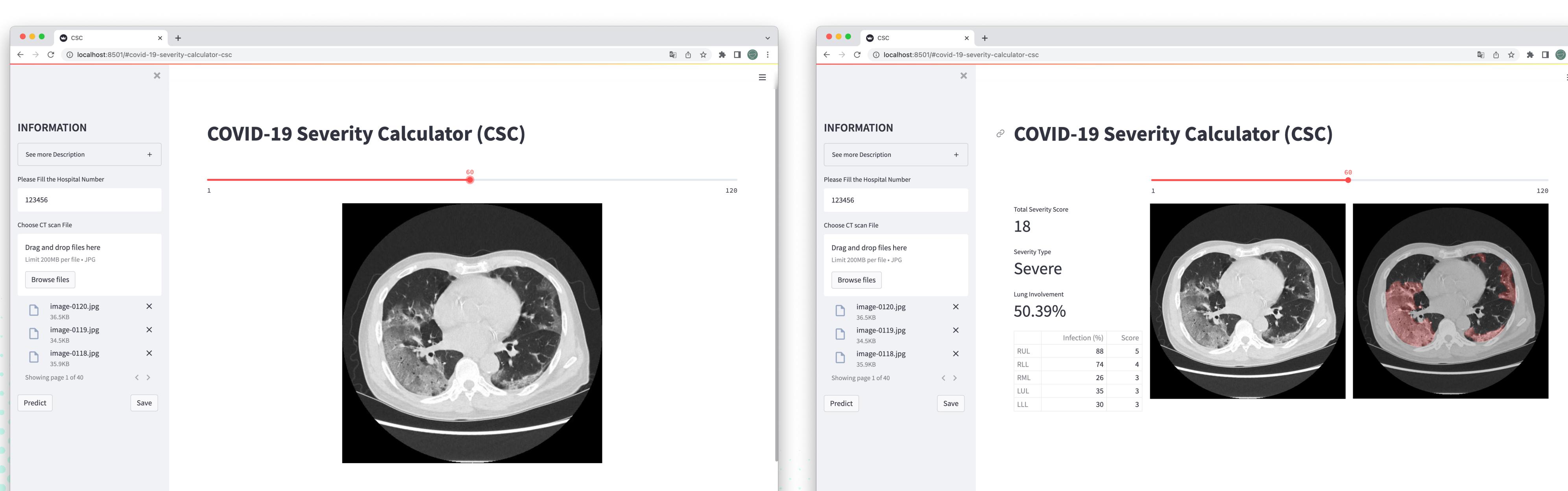


Percentage of Infection: PI | CT-Score

0%	0
<= 5 %	1
6% - 25%	2
26% - 50%	3
51% - 75%	4
> 75%	5

Score	Severity Type
<= 7	Mild
8-17	Moderate
>= 18	Severe

User Interface



source code:
<https://github.com/hds-69/csc-app>

Features

Result for each lung lobe

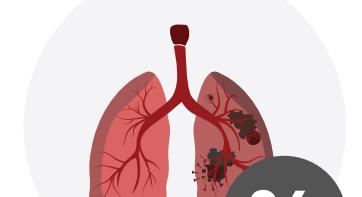
PI%: Percentage of infection
CT-score



TSS score



Severity type



Lung involvement

4.7
★★★★★
Overview Score

