Project No. 69

Segmentation of lung lobes and lesions in CT scans for severity classification of covid-19

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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 sematic 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.

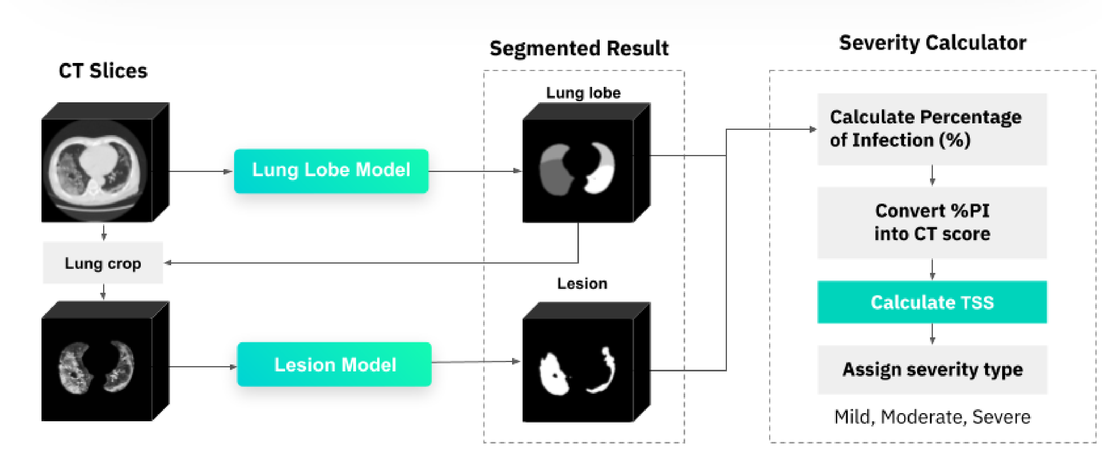
02 To create user interface that could help radiologists assess lung involvement and classify the severity of COVID-19.

Technologies

python™ | TensorFlow | jupyter | colab | Keras | Streamlit

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

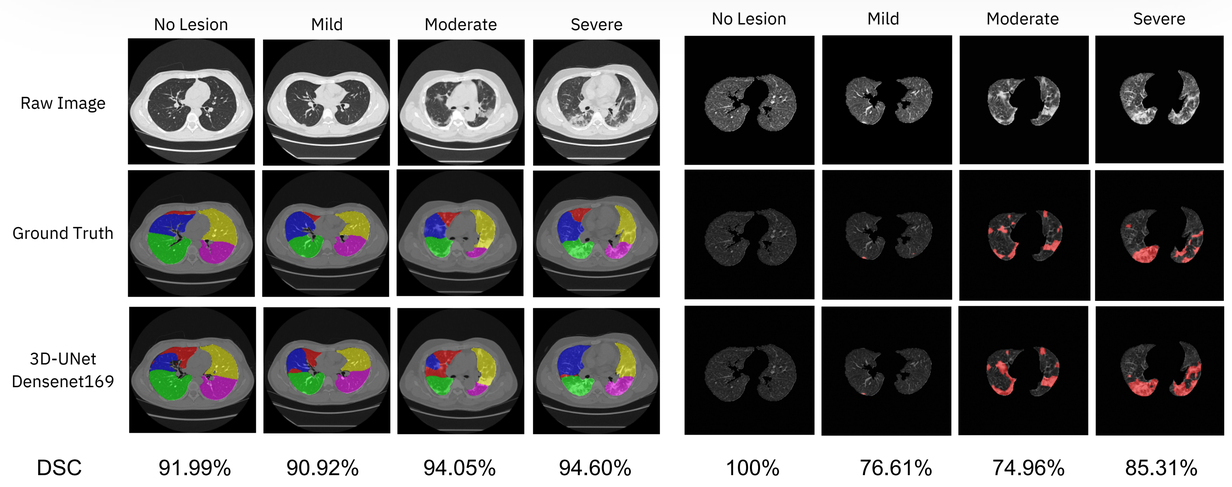
Lung Lobe Model 93%

Lesion Model 84%

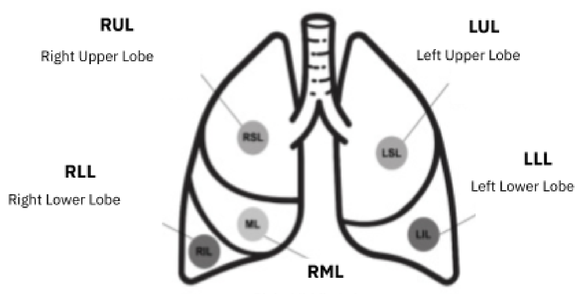
DSC: Dice Similarity Coefficient

Model-predicted vs Radiologist TSS

Regression Statistics	
Correlation Coefficient	0.9125
R square	0.8327
Observations	62
P-value	< 0.001



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

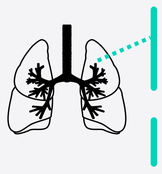


Percentage of Infection: PI	CT-Score
0%	0
<= 5 %	1
6% - 25%	2
26% - 50%	3
51% - 75%	4
> 75%	5

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

Features

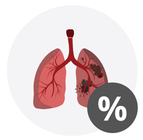
Result for each lung lobe



- PI%: Percentage of infection
- CT-score

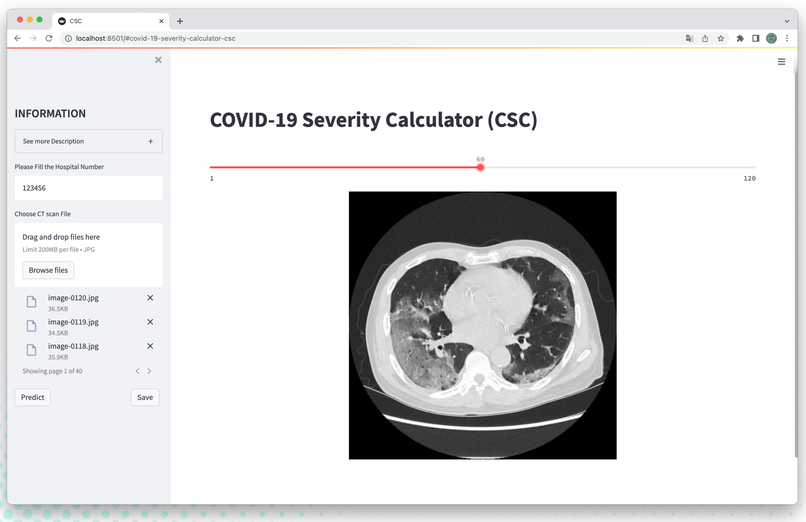
TSS score

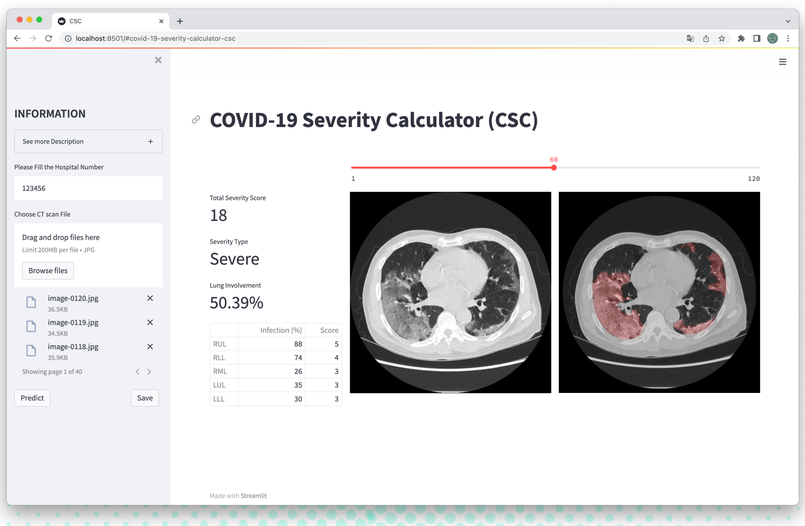
Severity type



Lung involvement

User Interface





4.7
★★★★½
Overview Score

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