COVID-19 Lung Infection Segmentation

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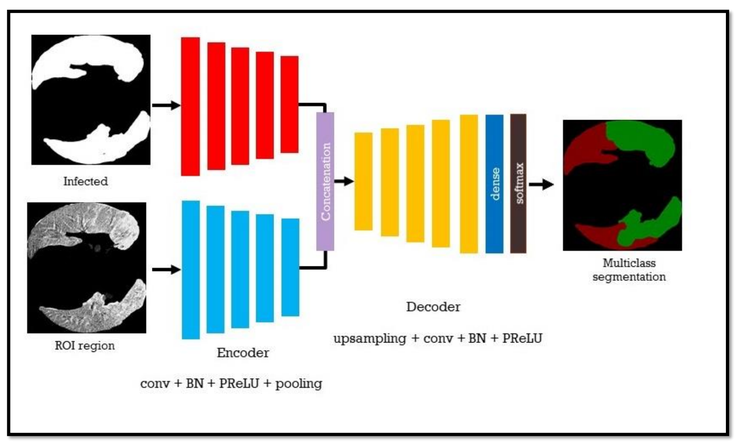
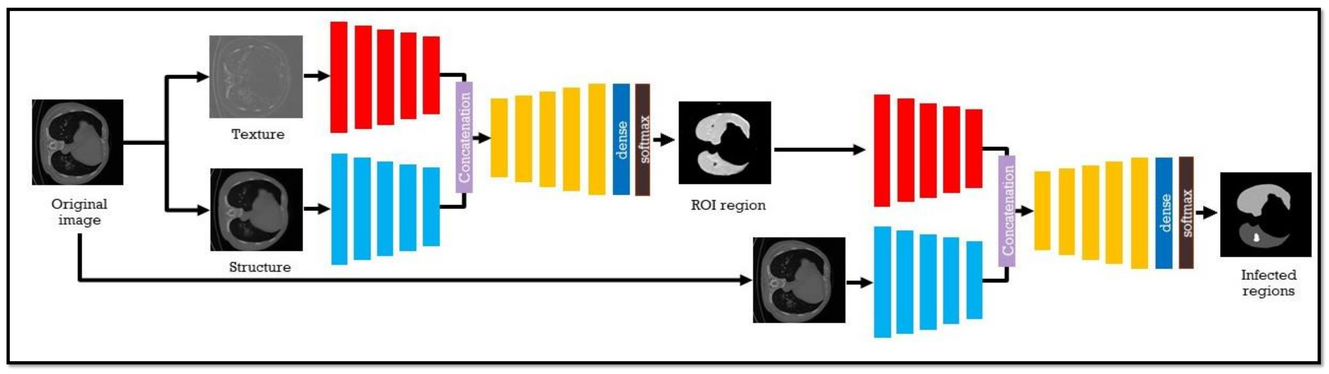
Introduction

The novelty of the COVID-19 Disease and the speed of spread, that create a colossal chaos, impulse all the worldwide researchers to exploit all resources and capabilities to understand and analyze characteristics of the coronavirus in term of spread ways and virus incubation time [1]. For that, the existing medical features like CT and X-ray images are used. For example, CT-scan images can be used for the detection of lung infection. But the challenges of these features such as the quality of the image and infection characteristics limitate the effectiveness of these features [2,3]. Using artificial intelligence (AI) tools and computer vision algorithms, the accuracy of detection can be more accurate and can help to overcome these issues. This poster proposes a multi-task deep-learning-based method for lung infection segmentation using CT-scan image.

System Overview

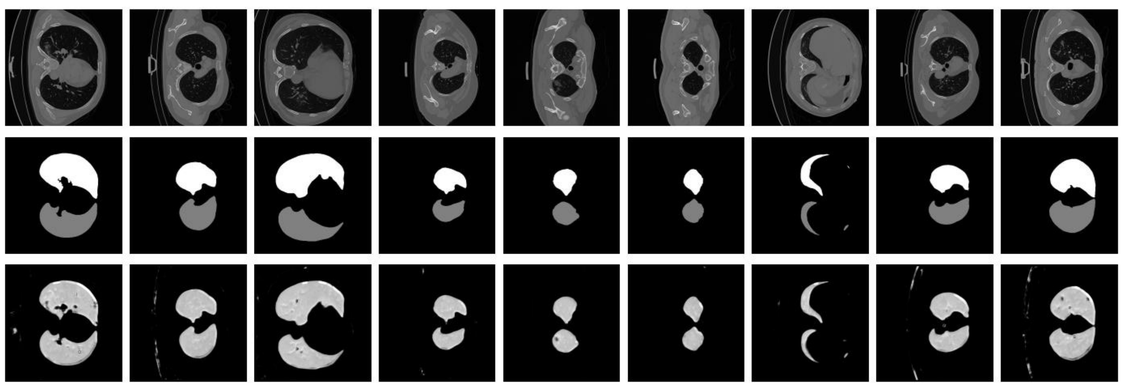




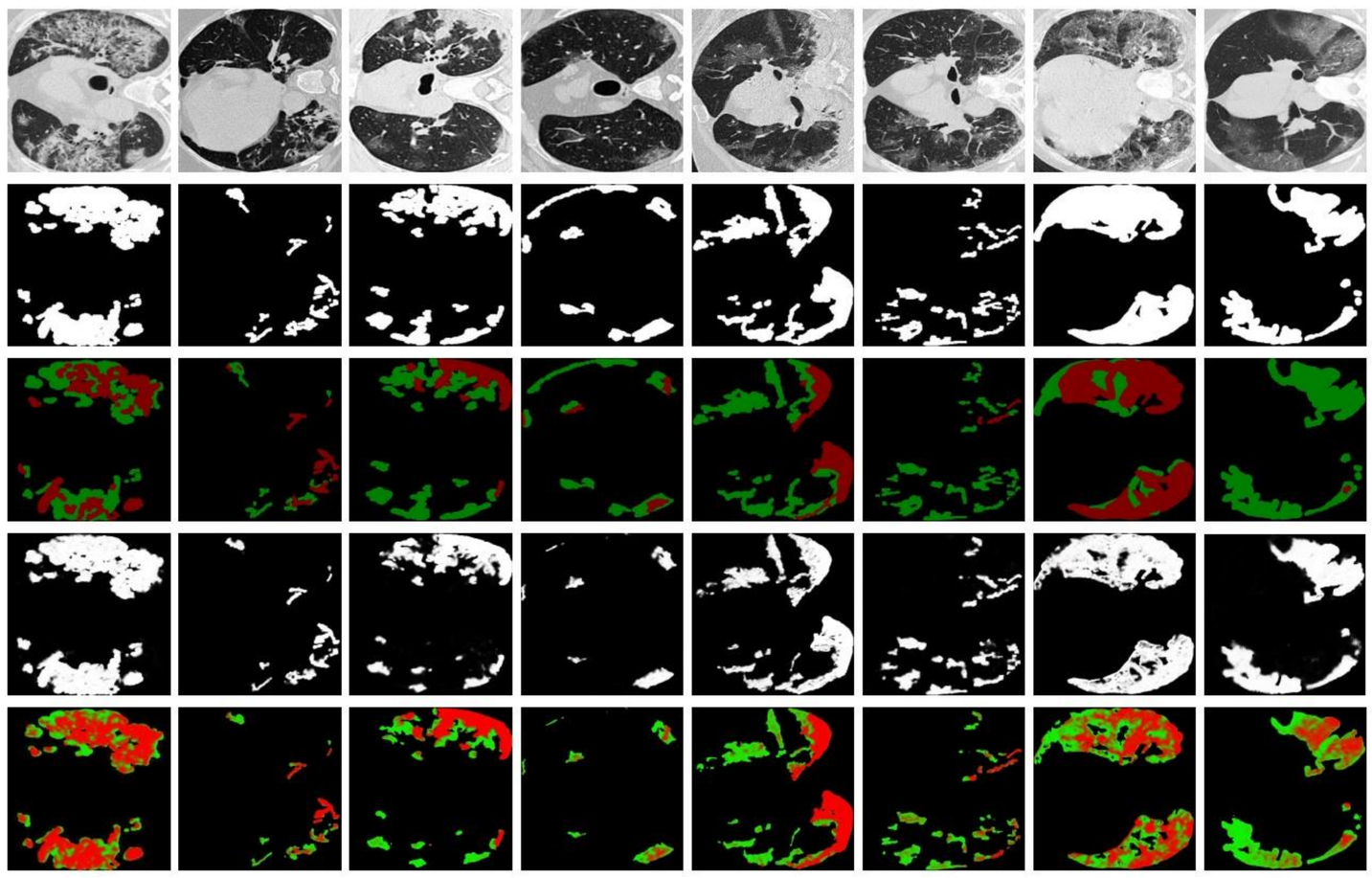
Methodology

Our proposed method starts by segmenting the lung regions that can be infected. Then, segmenting the infections in these regions. Also, to perform a multi-class segmentation the proposed model trained using the two-stream inputs. The multi-task learning used in this paper allows us to overcome shortage of labeled data. Also, the multi-input stream allows learning from features that can improve the results. To evaluate the proposed method, many features have been used. Also, from the experiments, the proposed method can segment lung infections with a high degree performance even the shortage of data and labeled images. In addition, comparing with the state-of-the-art method our method achieves good performance results.

Region of interest segmentation results.



Multi-class segmentation results.



Results

Comparison Results with Traditional State-of-the-art Methods

Method	Dice	Sensitivity	Specificity
Multi-class U-Net [4]	0.581	0.672	0.902
DeepLabV3+ [5]	0.341	0.512	0.766
FC8s [6]	0.375	0.403	0.811
Semi-Inf-Net [7]	0.541	0.564	**0.967**
Proposed Method	**0.640**	**0.630**	0.963

Discussion

The multi-class and binary infection labeling results shows that the proposed method performs an accurate segmentation of the lung infection using multi-class labeling. The best result comes from the succession of tasks for performing the multi-class segmentation. The use of the results of unit-class segmentation with the original image leads to a precise segmentation of the lung infection. The evaluation using different metric in Table 3 also demonstrate the advantage of the proposed method compared with the other existing methods. for example, the semi-inf-Net method succeed to obtain close results due to the multi-task learning model. In contrast to the other model that used as it is lime UNet of FC8s models.

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