



## Background

- Lung lobe segmentation is currently done in a semi-automatic manner.
- Semi-automatic lung lobe segmentation is infeasible for processes that require segmentation of multiple CT scans.

## Objectives

- To automatically segment the lung lobes in Fast Helical Free Breathing CT (FHFBC) scans.
- Develop a machine learning based framework for automated segmentation of lung lobes from FHFBC scans.

## Methods

- A set of 10 patient datasets (25 3D FHFBC scans each) were employed for this study.
- 150 FHFBC scans were employed for training.
- Lobes were first automatically segmented using Hessian matrix and fissure identification based algorithms.
- Motion blurring errors manually corrected using the Pulmonary Toolkit interface.
- Final segmentations used for adversarial neural network training.
- Generator network segmentation tested using remaining 100 FHFBC scans.
- Segmentations evaluated using image normalized cross correlation (NCC) metric.

## Techniques

- *Neural Network*: the neural network consists of generator and discriminator deep neural networks.
- *Generator Network*: the generator network generated the lung lobe segmentations.
- *Discriminator Network*: the discriminator ensured lobe segmentation accuracy.

## Results

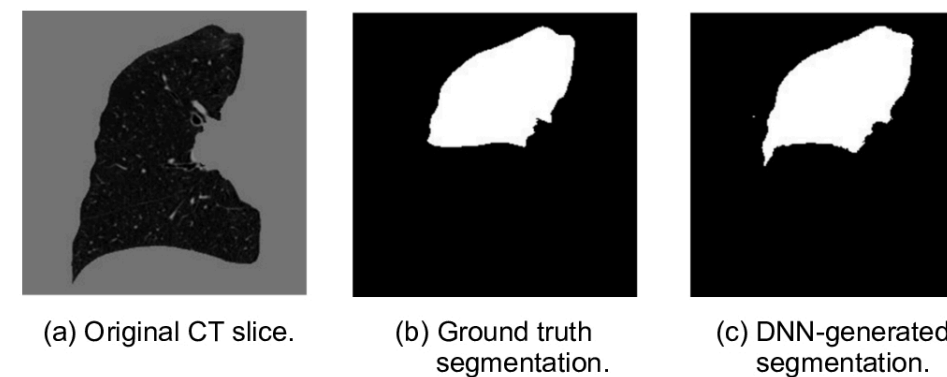


Figure 1: Example slice of results for upper right lobe segmentation

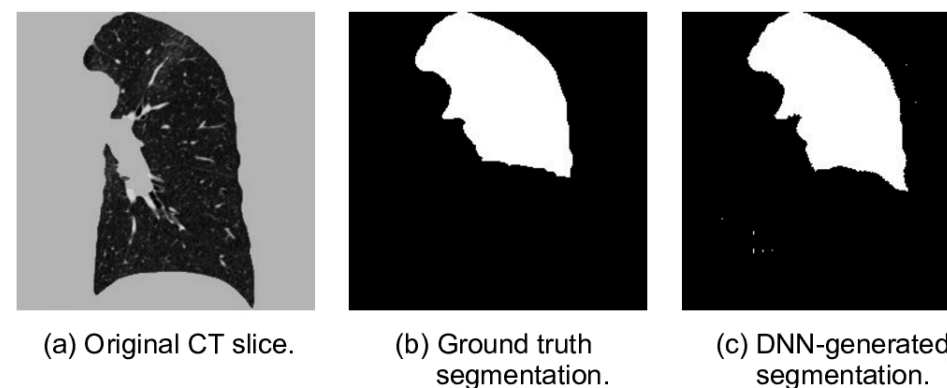


Figure 2: Example slice of results for upper left lobe segmentation

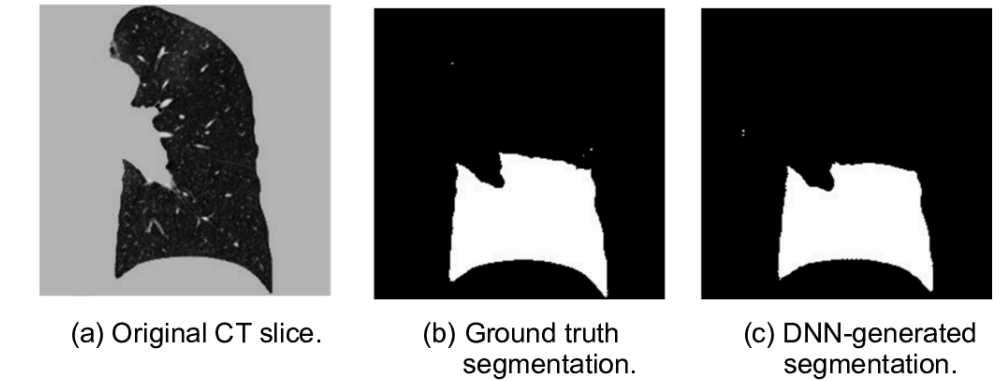


Figure 3: Example slice of results for lower left lobe segmentation

- Figure 1 shows an example of the image slice, ground truth segmentation generated by the Hessian matrix and fissure identification-based algorithms, and the DNN-generated segmentation for the upper right lobe. Figure 2 and 3 show the same for upper and lower left lobe, respectively.
- NCC values for lung datasets was consistently  $>0.9$ , improving upon  $<0.7$  from the conventional automated segmentation.

## Conclusions

- The figures shown offer an example of the general feasibility of a machine-learning generated lobe segmentation.
- An automated machine learning network was successfully used to segment lung lobes from FHFBC scans in near real-time.
- This provides a tool for automating a key component of pulmonary research and technique development for applications using FHFBC.

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## References

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