Tohoku Univ. Technology

Method for predicting lung function

Convert 3DCT to SPECT ventilation imaging

Overview

Pulmonary function imaging has been reported to provide valuable information for radiation therapy, and methods have been implemented to minimize dose deposition in high-functioning lung regions. Currently, most lung ventilation and perfusion imaging methods are based on the use of radioisotopes or contrast agents, such as single-photon emission computed tomography (SPECT) and positron-emission tomography (PET). Although these imaging techniques provide much useful information for local lung function, they have disadvantages such as radiation exposure, high cost, and requirement of special equipment. The inventors aimed to obtain lung function images from only 3DCT images taken at each treatment session.

In recent years, it has become common to use deep learning (DL) for some tasks in radiotherapy, especially convolutional neural networks (CNN) for image processing. In the past, there have been attempts to convert 4DCT images into SPECT images, but they have not been sufficiently successful. In this study, the inventors developed a DL-based method to directly convert 3DCT images into krypton -81M gas (81mKr-gas) SPECT V images for the first time in the world. The present invention shows the possibility of predicting lung function from CT images alone with high accuracy and is expected to contribute to radiotherapy.

Product Application

- ☐ Radiotherapy planning
- ☐ Diagnostic imaging

IP Data

IP No.	:	JP2023-107635
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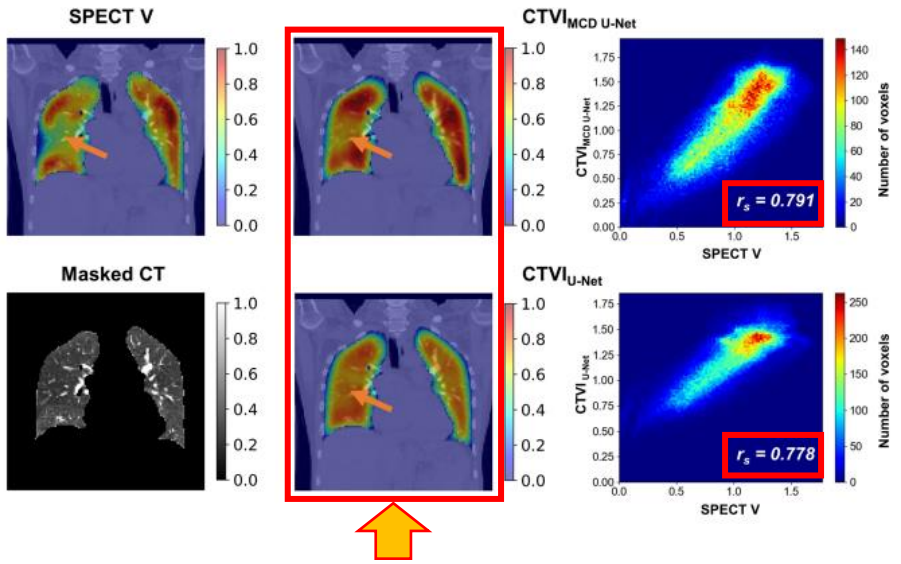
Successful conversion of CT to SPECT ventilation imaging with high accuracy



SPECT created on the basis of CT

	Method	Spearman r_s	Dice similarity coefficient High	Moderate	Low
$CTVI_{MCD\ U\text{-}Net}$	Bagging	0.76 ± 0.06	0.69 ± 0.07	0.51 ± 0.06	0.75 ± 0.04
	Average CV	0.73 ± 0.07	0.67 ± 0.07	0.48 ± 0.06	0.73 ± 0.05
$CTVI_{U\text{-}Net}$	Bagging	0.72 ± 0.05	0.66 ± 0.04	0.48 ± 0.04	0.74 ± 0.06
	Average CV	0.71 ± 0.06	0.65 ± 0.04	0.47 ± 0.04	0.73 ± 0.06

The correlation coefficient exceeded 0.7.
High accuracy was achieved.（0.5 or less in previous reports）

Related Works

Kajikawa T, Kadoya N, et al. Med Phys. 2022. Jul;49(7):4353-4364.
A deep learning method for translating 3DCT to SPECT ventilation imaging: First comparison with ^{81m}Kr-gas SPECT ventilation imaging

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