

Computer Aided Detection and Volume Estimation of Solitary Pulmonary Nodules Using Dual-Energy Subtraction Digital Radiography

Gyuseong Cho¹, Jin Sung Kim¹, Seong Kyu Ahn³, and Myung Jin Chung²

¹ Dep. of Nuclear and Quantum Engineering, Korea Advanced Institute of Science and Technology, ² Dep. of Radiology, Samsung Medical Center, ³ Nuclear Training Center, Korea Atomic Energy Research Institute

gscho@kaist.ac.kr

In medical chest radiography, because conventional CAD has difficulties to manipulate lung nodules due to bony structures, soft tissue-only images are preferable for nodule detection. Dual-energy radiography makes it possible to eliminate bone and other calcium structures from the chest image. In this study, the possibility of computer-aided detection and the accuracy of volume estimation of solitary pulmonary nodule (SPN) by using dual-energy subtraction digital radiography of the chest.

Dual-energy chest radiographic images of 13 patients with SPN were obtained. For the evaluation of this study, CT images for these patients were also taken within a day, and the volume of each targeted SPN was calculated from volume CT data. CT measured volumes of SPNs were from 0.13cm³ to 16.9cm³ (mean, 4.4cm³). Weighted log-subtraction dual-energy algorithm was applied to separate soft tissue from bone using the image processing for automatic detection of SPNs. Dual energy subtraction and followed image processing gave successful elimination of rib shadows and detection of SPNs in the tissue-selective dual energy radiographic images. The volume estimation of SPNs followed using density projection after background rejection around the SPN by background interpolation along the x- and y-direction of image pixels. Dual energy estimated volumes were from 0.17cm³ to 16.6cm³ (mean, 4.6cm³) and the mean relative error was 25% compared to CT measured volume. There was good correlation between dual-energy radiography (DER) estimated volumes and CT measured volumes (Pearson's coefficient = 0.991, p < 0.001).

The result shows that this method gives easier detection algorithm of SPNs and accurate estimation for isolated SPN from the lung boundary but with some errors for overlapping with the lung boundary. This estimation method based on dual-energy subtraction could be easily applied to the chest radiographic CAD to detect nodules and to measure the volume of them.

Keywords : Dual Energy, Computer Aided Detection, Lung Nodule