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Soft-tissue radiography using multi-scale convolutional neural networks

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The conventional chest x-ray radiography suffers from a less conspicuity of soft tissue lesions (e.g. lung nodules) because of overlapping bone tissues. Digital tomosynthesis (DTS) or dual-energy imaging (DEI) may enhance the soft-tissue conspicuity by discriminating depth information or suppressing the bone tissues, respectively. However, DTS requires additional equipment and DEI would be vulnerable to the motion artifact. Single-shot DEI using a multilayer detector may be free from the motion artifact, but it is known to be low contrast and high noise because of less energy separation [1].

Neural networks can be an alternative to the DEI [2]. We have previously shown the possibility of soft-tissue-enhanced radiography by using a shallow neural network [3], as shown in Fig.1. In this study, we extend the previous work to use a convolutional neural network (CNN) and expect better performance. The CNN consists of several convolution layers, pooling layers, and unpooling layers. The novelty of the network is that it is designed to be able to train multiple images with different spatial scales by assigning them into different layer channels. For the improvement of the network performance, the layout and hyper-parameters are being optimized. The network performance will be quantitatively addressed in comparison with DEI.

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