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P2.9: Deep learning-based soft-tissue decomposition in chest radiography using fast fuzzy C-means clustering with computed tomography dataset

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Chest radiography is the most routinely used X-ray imaging technique for screening and diagnosing lung and chest diseases, such as lung cancer and pneumonia. However, the clinical interpretation of the hidden and obscured anatomy in chest X-ray images remains challenging because of the bony structures overlapping the lung area. Thus, multi-perspective imaging with a high radiation dose is often required. In this study, to address this problem, we propose a deep learning-based soft-tissue decomposition method using fast fuzzy C-means (FCM) clustering with computed tomography (CT) dataset (Fig. 1). In this method, FCM clustering is used to decompose a CT dataset into bone and soft-tissue components, which are synthesized into digitally reconstructed radiographs (DRRs) to obtain large amounts of X-ray decomposition datasets as ground truths for training. In the training stage, chest DRRs and soft-tissue DRRs are used as input and label data, respectively, for training the network. During testing, a chest X-ray image is fed to the trained network to output the corresponding soft-tissue image component. To verify the efficacy of the proposed method, we conducted a feasibility study on clinical chest CT data from the AAPM Lung CT Challenge. Figure 2 shows the decomposed bone and soft-tissue components of the original CT image using the fast FCM and their synthesized DRRs. Figure 3 shows two cases of soft-tissue decomposition obtained using the proposed method and the measurements of the structural similarity index metric (SSIM). Consequently, the findings of our feasibility study indicate that the proposed method can offer a promising outcome for this purpose. More quantitative results will be presented in the paper.

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