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Digital tomosynthesis (DTS) reconstruction using deep learning with convolutional neural network

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Digital tomosynthesis (DTS) is a geometric tomography technique by limited-angle scan that has popularly been used in both medical and industrial x-ray imaging applications. It provides the tomographic benefits of computed tomography (CT) with reduced dose and time. However, conventional DTS reconstruction based on computationally-cheap filtered-backprojection (FBP) method typically produces poor image quality due to limited angular samplings. To overcome these difficulties, iterative reconstruction methods are often used in DTS reconstruction owing to the potential to provide multiplanar images of superior image quality to conventional FBP-based methods. Further, the compressed-sensing (CS), the development of three-dimensional reconstruction algorithms from sparse-view and/or limited angle-view data, as in DTS, has received growing attention during the last decade. However, they require enormous computational cost in the iterative process, which has still been an obstacle to put them to practical use. In this work, we propose a method for reducing limited angle artifacts effectively in conventional FBP reconstruction using a state-of-the-art deep learning with convolutional neural network. Recently, deep learning technique, which makes major advances in medical imaging processing, has been used image classification, denoising, and segmentation. Our results indicate that the proposed DTS reconstruction method effectively minimized limited angle artifacts, and its effectiveness was validated by comparing to other reconstruction methods such as FBP, CS for the DTS datasets.

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