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# Partially sampled digital tomosynthesis reconstruction using deep learning technique : Dynamic collimation and multislit collimation

Digital tomosynthesis (DTS) is a well-established multiplanar imaging technique that uses limited angular scanning to produce cross-sectional images of the scanned object with a moderate crossplane resolution. DTS images are typically reconstructed by using the computationally-cheap analytic filtered-backprojection (FBP) algorithm. This popular technique has been used in a variety of clinical applications such as chest imaging, mammographic imaging, and dental imaging owing to the fact that it provides tomography benefits at reduced radiation dose and scan time. DTS reconstruction methods at low radiation dose are an important field of research. Several methods for radiation dose reduction have been studied including sparse-view DTS, region-of-interest (ROI) DTS, and low-dose DTS. In a previous study [1], we investigated low-dose DTS reconstruction in partial sampling using a multislit collimation technique where a multislit collimator placed between the x-ray tube and the patient oscillates during projection data acquisition, partially blocking the x-ray beam to the patient thereby reducing radiation dose. Partially sampled DTS images reconstructed using the analytic FBP algorithm usually suffer from severe bright-band artifacts around multislit edges of the collimator due to incomplete spatial sampling. Thus, we revisited the FBP algorithm with a new prior sinogram interpolation method in an attempt to obtain a reasonable image quality in partially sampled DTS reconstruction. In this study, we propose the U-Net architecture for partially sampled DTS reconstruction to match the original image (multislit collimation) and fully-sampled image (no collimation). Figure 1 shows the FBP-reconstructed CT images using the fully-sampled projections, FBP-reconstructed DTS images using the original and the recovered projections for C(4/4) collimator, and the proposed DTS images using the XCAT phantom. Here C(n/n) denotes a collimator layout that blocks the x-ray beam over n detector pixels vertically with a n-pixel interval. As shown in Fig. 1, the reconstruction quality in the proposed DTS images was close to the CT images. Furthermore, the proposed DTS reconstruction more closely recovered the phantom structure in under-sampling situation (i.e., truncated and partially sampled imaging) compared to the FBP-based reconstruction. In this study, we investigated an effective method for using a deep learning scheme with convolutional neural network to reduce bright-band artifacts in partial sampled DTS.

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