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Reconstruction quality in 4D cone-beam computed tomography incorporated with deformable image registration method

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In conventional three-dimentional (3D) cone-beam computed tomography (CBCT) reconstruction, the image quality of reconstructed images is typically degraded due to patient's motion such as respiration and heartbeat. In order to solve these difficulties, 4D CBCT incoporated with a phase-angle sorting scheme is often utilized. However, in this case, it requires dense projections in each phase to obtain reconstructed images of high quality and also severe aliasing artifacts are often present due to the limited number of projections at each phase used in the reconstruction. In this study, as an alternative, we propose an effective method for reducing motion blur and aliasing artifacts in conventional 4D CBCT reconstruction, the so-called deformable image registration (DIR), and made a quantitative comparison of the reconstruction qualities by both shcemes. In the proposed method, DIR process is carried out in two different ways as follows. In the first way, DIR process is applied to the resultant reconstructed images in 4D CBCT, while in the second way to the original projections on the basis of the reconstructed projections that are produced by forward-projecting the reconstructed CBCT images in a single phase. The latter process is possibly performed using the adaptive steepest-descent POCS (ASD-POCS) algorithm for high reconstruction quality. Our results indicate that the motion blur and aliasing artifacts in the reconstructed CBCT images by using the DIR method were more significantly reduced, compared to the phase-angle sorting method. In addition, the second method in the DIR process seems more effective for reducing imaging dose than the first method.

Biography

Dongyeon Lee completed his MS degree from Yonsei University, Republic of Korea, and is a PhD candidate in the Department of Radiation Convergence Engineering at Yonsei University. He has published more than 10 papers in reputed journals and his research interests include CT, image registration, GPU acceleration, and so on.

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