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P2.51: Eliminating grid artifacts of crisscrossed antiscatter grids in CBCT for improving its image performance

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Cone-beam computed tomography (CBCT) is an efficient X-ray imaging modality that can reconstruct a wide area with single scan, compared to multi-detector CT. However, in CBCT, more scatters produced through the object reach detector surface, resulting in the reduction of image contrast. Recently, to address this problem, JPI healthcare Co. in Korea developed a prototype two-dimensional antiscatter grid, the so-called crisscrossed antiscatter grid, by adopting micro-controlled sawing process and carbon interspace material to improve its scatter removal ability. However, the most critical obstacle remaining for the successful use of crisscrossed grids in CBCT is the observation of grid artifacts (e.g., ring artifacts on CBCT images), which can result in a misdiagnosis by physicians [1]. In a previous study [2], we developed an effective software-based grid artifact reduction (GAR) algorithm for eliminating the related artifacts in two-dimensional (2D) radiography. In this study, to demonstrate the feasibility of the GAR algorithm to CBCT system with a crisscrossed grid, we modified the GAR algorithm for CBCT and conducted an experiment using a table-top setup. Figure 1 shows the schematic of a crisscrossed grid and an experimental setup used in this study. The setup primarily comprised a conventional X-ray tube (100 kVp and 4 mA), a focused crisscrossed grid (strip density of 43.8 lines/inch), and an a-Si/CsI flat-panel detector (145 μm pixel size).
Figure 2 shows the projection images of MK pro-CT II and ACR phantoms before and after applying the modified GAR algorithm. Figure 3 shows the resulting CBCT images of the phantoms using the standard filtered backprojection algorithm before and after applying the GAR algorithm. Figure 4 shows the measurements of contrast-to-noise ratio (CNR) and HU error of the two phantoms. Here the CNR and HU error of reference images without grid are also shown for comparison. According to our preliminary results, the image quality of the CBCT images were effectively improved by using the crisscrossed grid and the modified GAR algorithm. More quantitative experimental and simulation results will be presented in the paper.

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