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A new design of stationary dual-energy CT baggage scanner with pi-angle sparsity using compressed-sensing reconstruction

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For homeland and aviation security applications, two-dimensional (2D) x-ray inspection systems have been widely used, but they have limitations in recognizing 3D shape of the hidden objects. Hence, there has been increasing demand for x-ray computed tomography (CT) scanner for carry-on baggage screening. In a previous study [1], SSTLabs developed a prototype stationary CT baggage scanner with 2pi-angle sparsity where 9 pairs of x-ray sources and dual-energy detectors (linear-typed) in the opposite direction were distributed at the same angular interval. Each pair of x-ray source and detector is arranged along the z-direction so that different projection view data can be collected while the carry-on baggage moves continuously on the conveyor belt. This type of CT scanner is suitable for routine carry-on baggage inspection. However, owing to the limited number of projection views, a conventional CT reconstruction algorithm such as filtered backprojection (FBP) produces severe streak artifacts. In this study, we propose a new design of stationary dual-energy CT baggage scanner with pi-angle sparsity using compressed-sensing (CS) reconstruction for improving the image quality. The CS is a state-of-the-art mathematical theory for solving the inverse problems, which exploits the sparsity of the image with substantially high accuracy [2]. Figure 1 shows the proposed design of a stationary dual-energy CT baggage scanner with pi-angle sparsity of 15 projection views and preliminary simulation results of a numerical baggage phantom (300×300×100) obtained using the FBP and CS reconstruction algorithms. More systematic and quantitative simulation and experimental results will be presented in the paper.

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