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Noise-reduction approach to single-shot dual-energy imaging with a multilayer detector

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Dual-energy (DE) x-ray imaging can improve lesion conspicuity by suppressing anatomical background noise. Compared to the conventional radiography, however, DE imaging results in relatively higher image noise because subtraction of two energy images increases the resultant DE image noise, hence lowering signal-to-noise performance. Degradation of noise performance becomes severer in single-shot DE imaging, which uses a multilayer detector, because of high quantum noise in high-energy image due to the lower number of photons attenuated through the front detector.
We are developing the single-shot DE technique based on the multilayer detector. For more practical use of this technique, we apply noise-reduction strategy to high-energy images obtained from the rear detector layer before DE subtraction [1]. Figure 1 compares images obtained for a post-mortem mouse using a multilayer detector, and the Gaussian noise-reduction operation to the high-energy image shows a better DE image quality. However, the noise-reduction operation may yield an adverse effect in high-energy and DE images, for example, image blur. In this study, we investigate quantitatively the effects of various noise-reduction algorithms on the DE image quality. This study may find a best noise-reduction algorithm with less image distortion for the successful single-shot DE technique.

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