

A Pilot Study of Influences of Scan Speed on Image Quality for Digital Tomosynthesis

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Abstract : Chest radiography is the most common technique for the diagnosis and follow-up of pulmonary diseases. However, the lesions superimposed with normal structures are difficult to be detected in chest radiography. Chest tomosynthesis is a relatively new technique to obtain 3D section images from a set of low-dose projections acquired over a limited angular range. However, there are some limitations with chest tomosynthesis. Patients undergoing tomosynthesis have to be able to hold their breath firmly for 10 seconds. A digital tomosynthesis system with advanced reconstruction algorithm and high-stability motion mechanism was developed by our research group. The potential for the system to perform a bidirectional chest scan within 10 seconds is expected. The purpose of this study is to realize the influences of the scan speed on the image quality for our digital tomosynthesis system. The major factors that lead image blurring are the motion of the X-ray source and the patient. For the fore one, an experiment of imaging a chest phantom with three different scan speeds, which are 6 cm/s, 8 cm/s, and 15 cm/s, was proceeded to understand the scan speed influences on the image quality. For the rear factor, a normal SD (Sprague-Dawley) rat was imaged with it alive and sacrificed to assess the impact on the image quality due to breath motion. In both experiments, the profile of the ROIs (region of interest) and the CNRs (contrast-to-noise ratio) of the ROIs to the normal tissue of the reconstructed images was examined to realize the degradations of the qualities of the images. The preliminary results show that no obvious degradation of the image quality was observed with increasing scan speed, possibly due to the advanced designs for the hardware and software of the system. It implies that higher speed (15 cm/s) than that of the commercialized tomosynthesis system (12 cm/s) for the proposed system is achieved, and therefore a complete chest scan within 10 seconds is expected.

Keywords : chest radiography, digital tomosynthesis, image quality, scan speed

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