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Iterative correction method for shift-variant blurring caused by collimator aperture in SPECT

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A collimation system in single photon computed tomography (SPECT) induces blurring on reconstructed images. The blurring varies with the collimator aperture which is determined by the shape of the hole (its diameter and length), and with the distance between the collimator surface and the object. The blurring has shift-variant properties. This paper presents a new iterative method for correcting the shift-variant blurring. The method estimates the ratio of "ideal projection value" to "measured projection value" at each sample point. The term "ideal projection value" means the number of photons which enter the hole perpendicular to the collimator surface, and the term "measured projection value" means the number of photons which enter the hole at acute angles to the collimator aperture axis. If the estimation is accurate, ideal projection value can be obtained as the product of the measured projection value and the estimated ratio. The accuracy of the estimation is improved iteratively by comparing the measured projection vale with a weighted summation of several estimated projection value. The simulation results showed that spatial resolution was improved without amplification of artifacts due to statistical noise.

Key words: single photon emission CT, iterative correction method, shift-variant blurring, image processing