International Journal of Biomedical Imaging
Volume 2007 (2007), Article ID 63750, 9 pages
doi:10.1155/2007/63750

Research Article

Application of Blind Deblurring Reconstruction Technique to SPECT Imaging

Heng Li[1] and Yibin Zheng[2]

[1]Department of Radiation Physics, MD Anderson Cancer Center, University of Texas, Houston, TX 77030, USA
[2]Department of Electrical and Computer Engineering, University of Virginia, Charlottesville, VA 22904, USA

Received 30 March 2007; Accepted 21 September 2007

Academic Editor: Seung Wook Lee

Abstract

An SPECT image can be approximated as the convolution of the ground truth spatial radioactivity with the system point spread function (PSF). The PSF of an SPECT system is determined by the combined effect of several factors, including the gamma camera PSF, scattering, attenuation, and collimator response. It is hard to determine the SPECT system PSF analytically, although it may be measured experimentally. We formulated a blind deblurring reconstruction algorithm to estimate both the spatial radioactivity distribution and the system PSF from the set of blurred projection images. The algorithm imposes certain spatial-frequency domain constraints on the reconstruction volume and the PSF and does not otherwise assume knowledge of the PSF. The algorithm alternates between two iterative update sequences that correspond to the PSF and radioactivity estimations, respectively. In simulations and a small-animal study, the algorithm reduced image blurring and preserved the edges without introducing extra artifacts. The localized measurement shows that the reconstruction efficiency of SPECT images improved more than 50% compared to conventional expectation maximization (EM) reconstruction. In experimental studies, the contrast and quality of reconstruction was substantially improved with the blind deblurring reconstruction algorithm.