

S. Luo and T. Zhou, Superiorization of EM algorithm and its application in single-photon emission computed tomography (SPECT), *Inverse Problems and Imaging*, Vol. 8, pp. 223-246, (2014). DOI:10.3934/ipi.2014.8.223.

Abstract

In this paper, we presented an efficient algorithm to implement the regularization reconstruction of SPECT. Image reconstruction with priori assumptions is usually modeled as a constrained optimization problem. However, there is no efficient algorithm to solve it due to the large scale of the problem. In this paper, we used the superiorization of the expectation maximization (EM) iteration to implement the regularization reconstruction of SPECT. We first investigated the convergent conditions of the EM iteration in the presence of perturbations. Secondly, we designed the superiorized EM algorithm based on the convergent conditions, and then proposed a modified version of it. Furthermore, we gave two methods to generate desired perturbations for two special objective functions. Numerical experiments for SPECT image reconstruction were conducted to validate the performance of the proposed algorithms. The experiments show that the superiorized EM algorithms are more stable and robust for noised projection data and initial image than the classic EM algorithm, and outperform the classic EM algorithm in terms of mean square error and visual quality of the reconstructed images.