X-RAY MICROSCOPE IMAGE RECONSTRUCTION WITH ADAPTIVE ITERATIVE ALGORITHMS

Zheng Zhou, Xin Ni, Zhongping Zhang, and Ping-Chin Cheng
Electrical Engineering Department,
New York State University at Buffalo,
Davis Hall, White Rd, Buffalo, NY, United States.
E-mail:elepcc@gmail.com

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Due to the extraordinary penetration ability of X-ray, as well as the combination with the tomography and image reconstruction technologies, X-ray microscope has a unique advantage in revealing the inner structure of the observing object [1]. In X-ray microscope image reconstruction, it is a crucial step to take both the sharpness of reconstructed images and the robustness to noise into consideration, while this process yields manually-picked parameters based on expert knowledge and experimental experiences. Among the two major categories of reconstruction technologies, iterative reconstruction (IR) usually involves less prior knowledge compared with analytical reconstruction methods [2], however, a few parameters still need to be finely tuned.

In this work, we developed an adaptive iterative reconstruction algorithm for X-ray microscope, which allows the parameters update iteratively with the reconstructed images. IR algorithms commonly include edge-preserving or noise-suppressing regularization terms, and a group of parameters are used to decide how aggressively they are applied [3]. Our novel method could utilize the empirical parameters as initialization and ensure the flexibility within the following update stage, which balances the computational efficiency of algorithm and the different characteristics of observing objects. We evaluate our algorithm and demonstrate its advantages by comparing our results with the ones from traditional algorithms with fixed parameters.

Reference

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