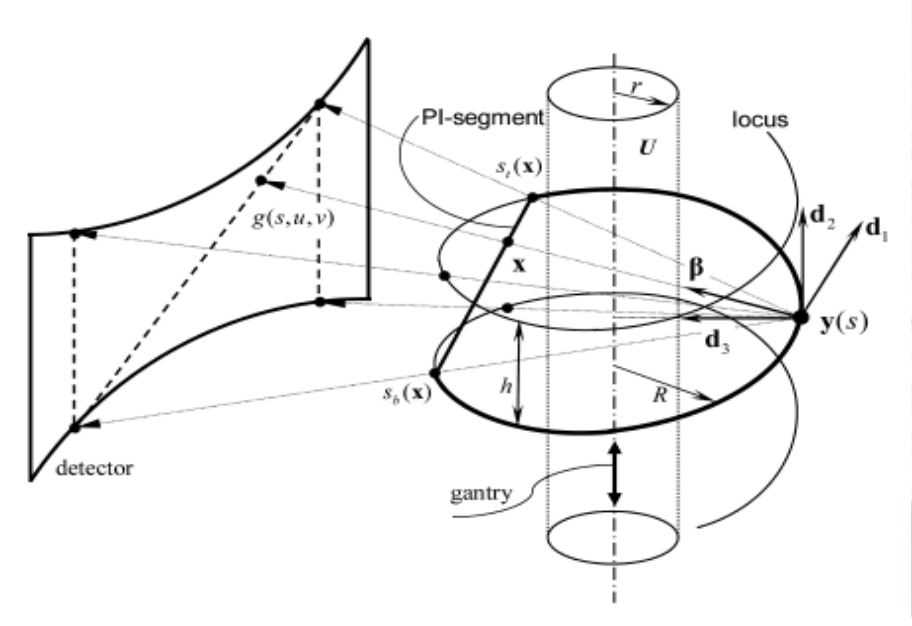
Fast CT Reconstruction — Practical Performance via Parallelization



Parallel computing has been used to solve large-scale problems in many fields. While CT is being developed towards high-resolution, volumetric, dynamic and spectral imaging, data-sets become increasingly large, and reconstruction speeds are often too slow. To meet this challenge, in 2004 Drs. Wang and Ni co-found a High performance Computing Lab, and have been working in this area ever since. ***In 2006, we designed and implemented the first parallel Katsevich algorithm****. We have also parallelized EM, OS-EM, SART and OS-SART algorithms, respectively.*

Quotation from Distinguished Peers

The above four algorithms were proposed in the theoretical detector-free form, with filtering lines derived for a flat panel detector. L ater, Noo et al. [13] showed that using the so-called "native geometry," that is, the geometry associated with a detector in use (which is curved for medical CT scanners, and flat for C-arm systems), results in more efficient implementation. Noo et al. provided the equations of the filtering curves in native detector coordinates and processing steps for implementation of the KVD -1PI algorithm. Another practical implementation scheme was proposed by Yu and Wang [14]. ***This type of work is essential for implementing of the exact algorithms on commercial CT scanners****.*

Katsevich A, Taguchi K, Zamyatin AA: Formulation of Four Katsevich Algorithms in Native Geometry. IEEE Trans. Medical Imaging 25:855-868, 2006

Publications by Our Team

Yu HY, Wang G: Studies on implementation of the Katsevich algorithm for spiral cone-beam CT. Journal of X-ray Science and Technology 12:97-116, 2004 ***(Reference [14] cited above; the most cited paper in this journal since 1994, according to Scopus)***

Li X, Ni J, Wang G: Parallel iterative cone-beam CT image reconstruction on a PC cluster. Journal of X -Ray Science and Technology 13:63-72, 2005

Deng JJ, Yu HY, Ni J, He T, Zhao SY, Wang LH, Wang G: A parallel Katsevich algorithm for 3-D CT image reconstruction. Journal of Supercomputing 38:35-47, 2006

Ni J, Li X, He T, Wang G: Review of parallel computing techniques for computed tomography image reconstruction. Current Medical Imaging Reviews 2:405-414, 2006

Ni J, Deng JJ, He T, Yu HY, Wang G: Analytical model for performance evaluation of parallel Katsevich algorithm for 3-D CT image reconstruction. To appear in International Journal of Computer Science and Engineering.

Deng JJ, Yu HY, Ni J, Wang LH, Wang G: High-speedup strategy for parallel iterative CT. To appear in Journal of supercomputing