

Speeding up image reconstruction in computed tomography

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Computed tomography (CT) is a technique for imaging cross-sections of an object using X-ray measurements taken from different angles. In last decades a significant progress has happened there: today advanced algorithms allow fast image reconstruction and obtaining high-quality images even with missing or dirty data, modern detectors provide high resolution without increasing radiation dose, and high-performance multi-core computing devices are there to help us solving such tasks even faster.

I will start with CT basics, then briefly present existing classes of reconstruction algorithms and their differences. After that I will proceed to employing distinctive architectural features of modern multi-core devices (CPUs and GPUs) and popular program interfaces (OpenMP, MPI, CUDA, OpenCL) for developing effective parallel realizations of image reconstruction algorithms. Decreasing full reconstruction time from long hours up to minutes or even seconds has a revolutionary impact in diagnostic medicine and industrial non-destructive testing applications.

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