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Title: Fast tomographic reconstruction with vectorized backprojection.

Abstract:
Electron tomography allows elucidation of the three-dimensional (3D) structure of large complex biological specimens at molecular resolution. In order to achieve such resolution levels, large projection images have to be used to compute the 3D reconstructions. Tomographic reconstruction on this scale requires an tremendous use of computational resources and considerable processing time. In this work, we present and evaluate a vector approach for fast 3D reconstruction that takes advantage of the multimedia extensions in modern processors. We have implemented the standard 3D reconstruction method, weighted backprojection, using the Streaming SIMD Extensions (SSE) to fully exploit the mputational capabilities of the processors. We have evaluated the method on tomographic reconstruction of several datasets of various sizes, and on a range of different computing platforms. The results show that the vector approach speeds up the method by a factor around 3.

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